MUNICIPAL ENGINEERING

The World's Leading Municipal Publication

VOL. XLIX. SEPTEMBER, 1915. No. 3.

EDITORIAL

THE MUNICIPAL FIRE DEPARTMENT.

Progress and recent developments in the fire departments of American cities are reflected in the statistical tables presented in this issue of MUNICIPAL ENGINEERING. It is a significant fact that even small cities thruout th United States are rapidly equipping with motor-driven apparatus and the contemplated purchases for the coming year aggregate more than twenty millions of dollars. The detailed reports indicate that fire losses are being reduced each year, and that the cities equipped with motor apparatus show a lower rate of loss, on the average, than those equipped with horse-drawn apparatus.

The statistical facts presented in this issue of Municipal Engineering show, for each city represented, the most complete array of detailed information ever published. Nearly 1,000 cities have reported and the care with which most of the reports have been compiled clearly indicates the lively interest which fire chiefs, everywhere, feel in procuring a complete and permanent record of facts, which will serve as a basis for the future development of every fire department in the United States. The city confronted with the problem of improving its fire service can, from this record, ascertain with accuracy the kind of equipment and the system employed by other cities of similar size.

It has been impossible to publish all of the reports received in this issue. Supplemental tables will be presented in the October issue, together with a summary of fire losses, operating expenses and other facts of interest.

Referring to the statistical tables appearing in the Fire Apparatus supplement in this issue of Municipal Engineering, it is to be noted that Table I gives for each city, the population, area, number of Fire Houses, number of men, number of miles of streets (paved and unpaved), the condition of streets, the source of water supply, fire pressure, normal pressure; number of hydrants, number of miles of water mains, number of cisterns, method of delivery, number and kind of motor fire apparatus, name of the chief, and name of the chairman of the fire committee or governing body. It also gives facts relating to building inspection and platoon system. *In a later issue the relation between the various features of the fire system and the reported fire losses will be discussed and the extent of the value of motor fire apparatus will be definitely established.* Table II. describes in detail each piece of motor fire apparatus in each city, so far as it has been possible to obtain the facts, and summarizes the auxiliary equipment and the service performed by each piece of apparatus in the past year. Table III. is a partial summary of contemplated purchases of new equipment proposed for the coming year together with the names of the fire chief and the governing committees.

BUILD ROADS FOR TRUCK TRAFFIC.

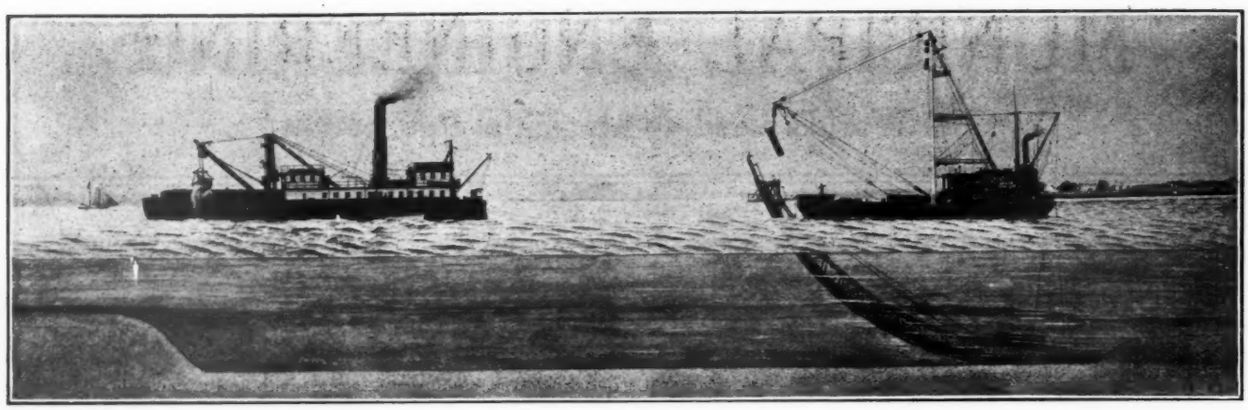
The experience of the States earliest in the field of good road constructions was bought very dearly and it has taught the lesson that the improvement of a main road changes materially the character of the traffic and, if the road has been built for the existing traffic a rebuilding is necessary to fit it for the new traffic which is greater and of different nature.

The rate of growth of such traffic depends upon the locality and upon the influence of the good road upon the development of the tributary country in population or in amount of road trafic or both. Records of such increase are more complete in England than in this country. The record for one road out of Birmingham will give some indications of what may be expected.

The road in question was a water bound macadam road originally, and had given good service, with some aid from tar painting on the surface under the traffic prior to January, 1915, which at that time amounted to 4,669 tons a week, of which 1,754 tons was motor traffic. About that time motor omnibus traffic began and in the six months from January to July, 1913, increased from 24 to 3,450 tons per week, while other traffic increased less than 100 tons in the same period. By May, 1915, the motor omnibus traffic had increased to 3,756 tons per week, or 67 tons per yard of width per day, and the other traffic had increased to 8,407 tons per week, practically all of the increase being in motor traffic other than motor omnibus.

The tar painted macadam rapidly deteriorated under the omnibus traffic and it was resurfaced in 1914 with four inches of tar macadam as the repair gang could not keep pace with the wear and the cost of maintenance was excessive.

Similar experience in America demonstrates that the new main roads to be economical in the long run must be improved with the hard surfaces necessary to carry the heavy truck traffic and that anything short of this will be a waste of money in construction and in maintenance.



THE WATER MAIN UNDER NEW YORK HARBOR

FROM BROOKLYN TO STATEN ISLAND

By J. F. Springer, New York City.

In distributing the new Catskill water supply to the different boros of the city of New York it became necessary to lay a pipe from Brooklyn to Staten Island across New York Harbor. The drawing at the head of this article shows the dredge making a trench in which to lay the pipe line in the trench. The article describes the process, which differs from other cases of the sort in its magnitude, in the special local conditions of tides, currents, and traffic not to be interfered with, and the special apparatus employed.

THE Catskill aqueduct, supplying water to the boros of New York City, has several types of inverted siphon construction, from those which cross the valleys of Rondout creek and Hudson river to that which passes beneath the Narrows between Long Island and Staten Island, including depressed rock tunnels, sheet steel siphons covered inside with cement mortar and outside with concrete, and cast iron pipe. The latter is the type of the line from Brooklyn to the boro of Richmond, on Staten Island.

The line of the aqueduct begins in the Catskill mountains, about ninety miles to the north of New York, and on the opposite side of the Hudson river. The crossing of the river is made at Storm King mountain, not very far from West Point. The Harlem river is crossed far beneath the surface and the conduit carried thru Manhattan Island at a very considerable depth. Near the southern end of the island the line passes beneath the East river to the boro of Brooklyn. Finally it makes the passage to Staten Island beneath the Narrows.

Staten Island is now the least populous of all the boros of the great city. This is no doubt largely due to its distance from Manhattan Island and to the absence of land transportation connections with the two great boros. However, this section of the city is being provided with a water supply having a capacity of some 15,000,000 gallons per day.

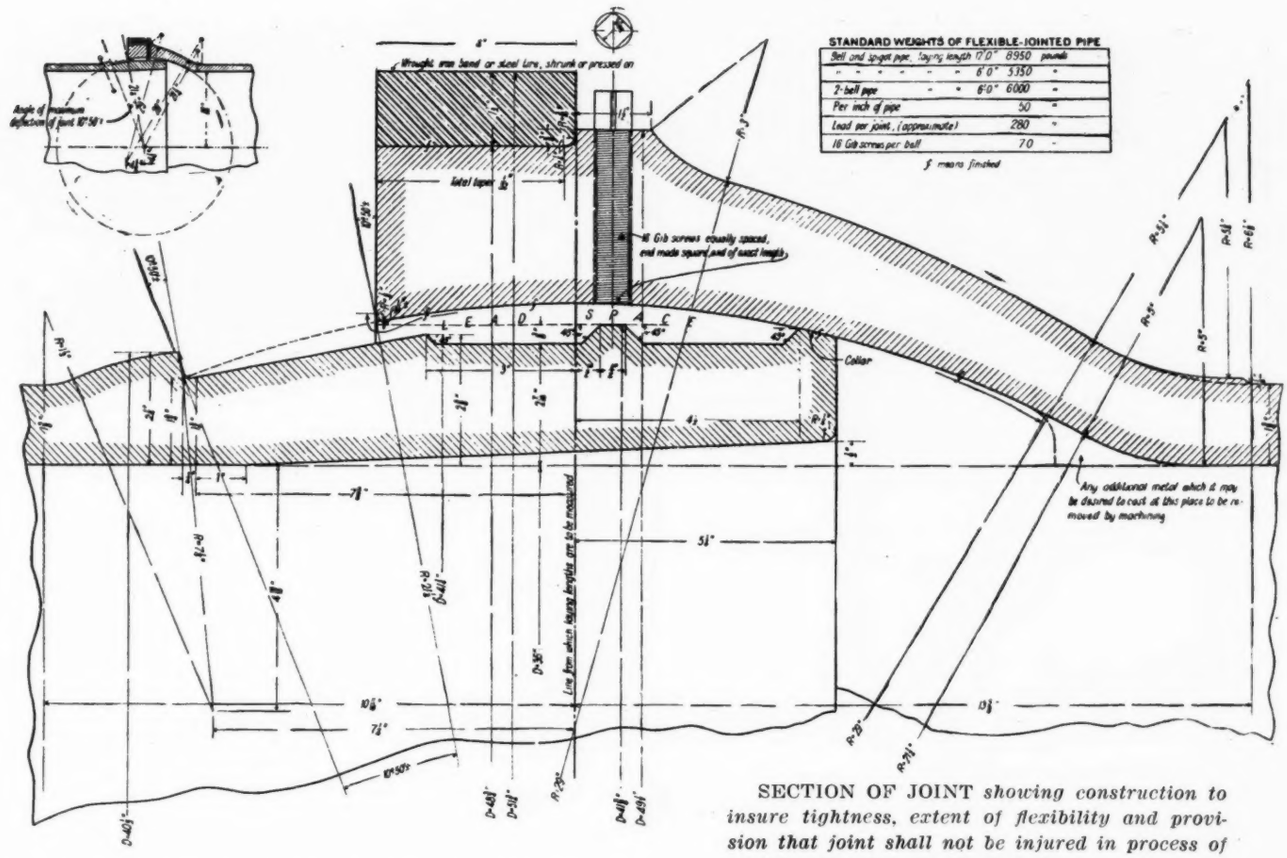
The Narrows is the name of the strait connecting Upper New York bay with Lower New York bay. It is perhaps the most frequently traveled of all salt water routes in the world. The great liners, the tramps, and shipping generally pass thru it. Whatever means of carrying the aqueduct across was adopted, it had to permit construction without stoppage of maritime traffic. Then currents had to be reckoned with, and also a maximum depth of some 50 or 60 feet. The point selected for passage from Brooklyn is at Seventy-ninth street. On the Staten Island side the siphon comes to land at a point very near the most northerly part of the island. The crossing is accordingly made at a location where the Narrows has by no means its narrowest width.

The War Department made the requirement that no more than 1,000 feet of the channel was to be obstructed at any one time. The line of pipe lies in a trench of such depth that a covering never less than 8 feet lies over the top of the pipe.

The pipe was let down length by length as the joints were made. That is, the end of the pipe line was on board a float, where it would be lengthened section by section. A portion of the connected-up line of pipe was passed down the guides off the float as new pipes were connected up, thus lengthening the part already in place in the trench. It will be seen at once that this means a great deal of bending. Not only was the line compelled to bend to conform to irregularities at the bottom of the trench, but very severe deflections occurred between float and trench. In order to provide for the necessary flexibility of joint, a special design of spherical socket joint was adopted.

The sections paid out from the float from time to time averaged about 12 feet in length and weighed four or five tons. The diameter of the pipe is 36 inches. The specifications permitted no variation from this greater than 3/16 inch. They also require that the pipe shall pass a hydraulic test of 350 pounds per square inch, and also a hammer test carried out while the hydraulic pressure is on.

The joint has bell and spigot ends. The bell is machined on the inside to a spherical surface. The spigot does not come into actual contact with this surface except perhaps at the extreme end of the spigot. Back of this point, and occupying the space between spigot and bell, a filling of lead is employed. The spigot is provided with circumferential ribs, which tend to keep the leaden filling in place. The exterior surface of the


STANDARD WEIGHTS OF FLEXIBLE-JOINTED PIPE
Spigot and spigot pipe, laying length 17'0" 8950 pounds
" " " " " 8'0" 5350 "
2-bell pipe " " 8'0" 6000 "
Per inch of pipe 50 "
Lead per joint, (approximate) 280 "
16 Gib screws per bell 70 "
f means finished
Wrought iron band or steel bars, shrunk or pressed on
16 Gib screws equally spaced, and made square and of exact length
LEAD
SPACE
Collar
Any oddlances metal which it may be desired to cast at this place to be removed by machining
Line from which laying lengths are to be measured

SECTION OF JOINT *showing construction to insure tightness, extent of flexibility and provision that joint shall not be injured in process of reaching its place in the trench.*

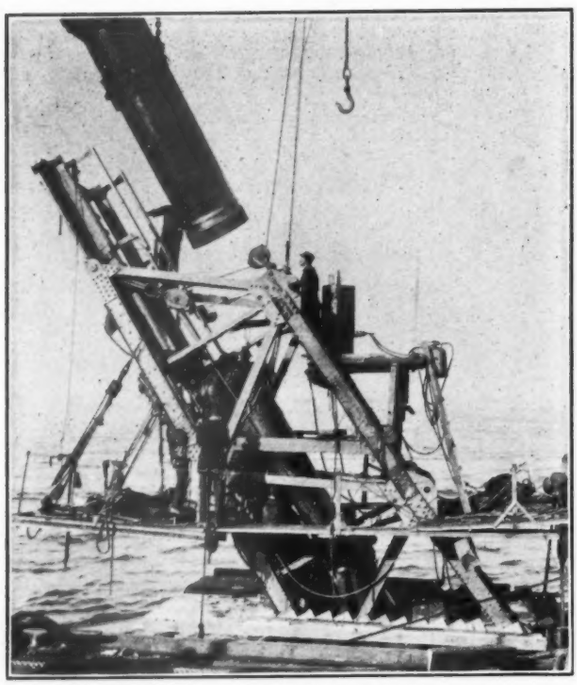
lead conforms precisely to the spherical surface of the bell. As the one length of pipe bends out of line with the other, the two spherical surfaces slide upon each other. The final 4 inches at the extreme end of the bell is protected by an exterior band of wrought iron or steel. This band is shrunk on at the shop. Its purpose is to reinforce the hub end of the pipe during laying. If this band corrodes later on, it is deemed a negligible matter. Back of the reinforcing band the bell is pierced by threaded holes which give access to the lead. Gib screws fit into the holes and provide a means of forcing the cold lead into the shrinkage space of the joint. Three hundred pounds of lead were required per joint.

One of the principal difficulties which had to be taken care of was the matter of shrinkage of the filling after it was put in place. Two compositions (lead:tin, in proportions of 4:1, and lead:antimony of 19:1) were tried as fillers, but in both cases the shrinkage was such upon cooling that the leakage was excessive. Tight calking of lead wool was tried. This produced a tight joint, but did not permit the flexibility of movement desired. Pneumatic calking of molten lead was also experimented with. The hammer operated under a gage pressure of 60 to 80 pounds per square inch. There was a pressure of 200 pounds on the joint at the time. The calking proved ineffective. What proved successful was the use of tap screws, which forced down fresh lead upon the cold lead in the joint after it was poured. It will be understood that joints were made at the surface. The preliminary test seemed to show that a single row of gib screws was sufficient, but it was found advisable later on to employ a double row. As much as 22 pounds of fresh lead could in this way be introduced to take up the space vacated by shrinkage. The lead was forced in by means of four air drills operating simultaneously upon a single joint. These drills were supported by a suitable carriage which could be rotated round the band. This method permitted calking of a joint to be done in one hour.

The requirements of laying the pipe imposed upon the contractor a limitation of the deflection within the joint, while laying, to 5 degrees. This matter was controlled by the use of an enormous cradle built of structural steel and resembling a thru truss. There are fourteen panels, each 12 feet in length, thus corresponding to the pipe lengths. The cradle is curved in a vertical plane, and, when in normal position, extends from one end of the scow down and back to the bottom of the trench. Fourteen lengths may lie at once in this cradle, or skidway. The curvature is such that the deflection from pipe length to pipe length keeps to the 5 degrees permitted. One length is always going into place and another is always being added. A new length is swung into place, spigot end down. To set it correctly requires perhaps twenty minutes. The lead is then poured, which occupies another twenty minutes. The filling up of the shrinkage space then takes sixty minutes. The operation of moving the scow ahead and allowing the new pipe line on the cradle to be paid out one length occupies about twenty minutes more. A great deal of time was lost, however, by miscellaneous irregularities, so that the ordinary average time taken per length, under good weather conditions, amounted to three hours.

The second operation, that of pouring the lead, was carried out while the new pipe length was held in position in the cradle by cables. So, also, with the next operation, where lead pellets were forced in to take up shrinkage space. The cables were then released and the pipe's support assumed by a derrick. Everything was now ready for the scow to move ahead and let the loop of pipe line slide conformably to the three guides arranged in the cradle—one at the bottom and one to either side of the pipe.

The cradle was quite a large affair, measuring about 180



LOWERING A SECTION OF PIPE *into place. The men on the platform below are finishing the enameling of the preceding pipe length. The lead pot for pouring the joint is seen on the small platform above.*

feet in curved length, having a width of 8 feet, and maintaining a height of about 10 feet. The weight approaches sixty tons.

I have already called attention to a rather novel mechanical appliance which is employed in operating the gib screws which force the lead pellets into the lead filling. Machine operations are also required in preparing the pipe ends for the making of the joint. The sphericity of the interior of the bell must be of a high degree of perfection in order to provide for slippage without breaking up the tightness of the joint. The specifications are excessively severe. There are to be no chatter marks, no tool cuts, no depressions. The sphericity is to be maintained to about 0.01 inch. The exterior of the bell must be accurately machined to receive the reinforcing band. This band is then shrunk on prior to the machining of the inner bell surface.

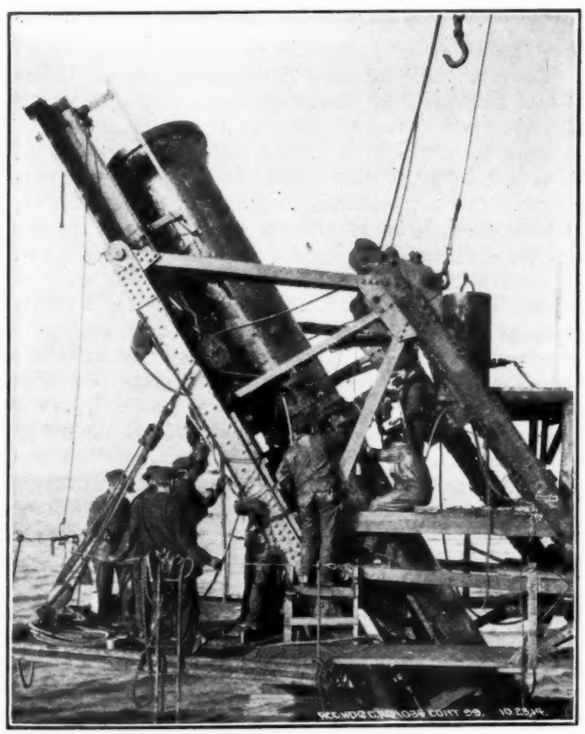
The manner of cutting the hollow cylindrical surface is of interest. Briefly, it consists in swinging the cutting tool in a horizontal plane while the pipe is rotated in a vertical plane. A pipe length is mounted on a big lathe in such way as to be turned by the head. On a bracket secured to the tailstock a rotating table is set up. The plane of its rotation is horizontal. On the table the high-speed cutting tools are mounted. These are three in number, two for rough cutting and one for finishing. The tools are arranged at such intervals that when the one engaged in cutting has entered the bell to the point where it ceases its activity, the next tool approaching the exterior point where cutting begins is about an inch from its work. This space provides for an interval of time, during which the operator changes the feeding speed. After the three cuts have been made, the surface is ground to finished size. This operation is accomplished by means of a grinding wheel mounted upon the armature shaft of a 3-h.p. electric motor set up on the rotating table.

All this careful work is necessary to the prevention of leaking joints. It is appropriate to add here that machine operations upon material intended for the field are probably on the increase. This seems to be especially the case where joints are to be made. It adds to the cost of the material, but it provides a certainty of tightness that probably is worth much more than the expense. In the present case the pipe lengths are required to be interchangeable. There is, accordingly, no need in the field to match a given bell with some particular spigot. Any spigot fits any bell.

After being machined and ground the pipe lengths are taken in truck loads to the testing plant. This plant is provided with a big water tank from which the length to be tested may be quickly filled. A length is rolled off the truck onto a track, to either side of which an end plate is set up. One of these is fixed in position and the other is movable. Both stand in vertical planes. The length is rolled between the two, and the movable one operated against one end of the pipe. The joints are made tight by means of suitable rubber gaskets. The pipe is filled with water and simultaneously the air is permitted to escape. When water comes out of the vent during the filling operation it indicates that the pipe is full. The movable plate is operated by means of two hydraulic jacks. These have a movement of, say, 1½ inches or less. A four-plunger pump is employed to work the jacks, whose combined power is about 250 tons. This pressure is just about sufficient to resist that of the water in the pipe when the maximum test of 350 pounds per square inch is realized. A single-plunger pump is used to bring the interior pressure up to the desired point.

In the field the dredging required to provide a suitable trench was rather difficult. In the first place, the bottom required is, for the larger part of the 1¾-mile crossing, at a

PIPE IN PLACE *and joint poured. Workmen are forcing lead pellets into the joint to insure its tightness. Note two air-driven machines for use in this operation.*



depth of 59 feet below mean sea level. The maximum depth is about 74 feet. This is on the side near Staten Island. The depth of the dredge cut varied from 10 to 35 feet. At first it was thot possible to dredge a satisfactory trench by making the bottom width 20 feet; but this was found to be entirely inadequate for the reason that the trench had to be left for a number of weeks between dredging and laying. Light mud would be carried down into the trench under the influence of the currents set up by moving the scow and cradle. In fact, the mud filled in to depths up to 10 feet. It was really possible to drag the cradle thru this mud, but its presence prevented examination of the freshly-laid pipe by divers. Besides, the cradle would not settle quite to the bottom, altho the pipe would. With the cradle not quite down, an excessive deflection was imposed upon the pipe lengths sliding off its end. The bottom width of the trench was doubled and satisfactory results secured. The dredging could not be done, it appears, in the more advantageous way by proceeding parallel to the central axis, but was necessarily carried out in short lengths from one side of the trench to the other. This requirement was imposed by the strength of the tidal current running, whether in or out, at right angles to the pipe line. The depth prohibits the use of a ladder or dipper dredge. Poles could not be used to guide the bucket. The tide would swing the bucket many feet away from correct position. Not only was the excavating difficult to do, but it was difficult to tell when a satisfactory job was done. Only at slack water could soundings be made. The information supplied thus was insufficient. It did not tell whether the bottom was even enough. In fact, after about one-third of the pipe was dawn, it was concluded that a better bottom was needed. Divers armed with jets sought to produce an even bottom, but this procedure proved too slow and expensive. A heavy A-shaped drag was then constructed out of structural steel, the total weight amounting to something over ten tons. By dragging this appliance back and forth on the bottom, the latter was brought to a level condition. The dredge employed in the Narrows operations is of the clam-shell variety. The bucket generally used weighs 26,000 pounds and has a capacity of 6½ cubic yards. Now and then a mud bucket was used. Upon the average, 3,800 cubic yards has been excavated per day of three shifts.

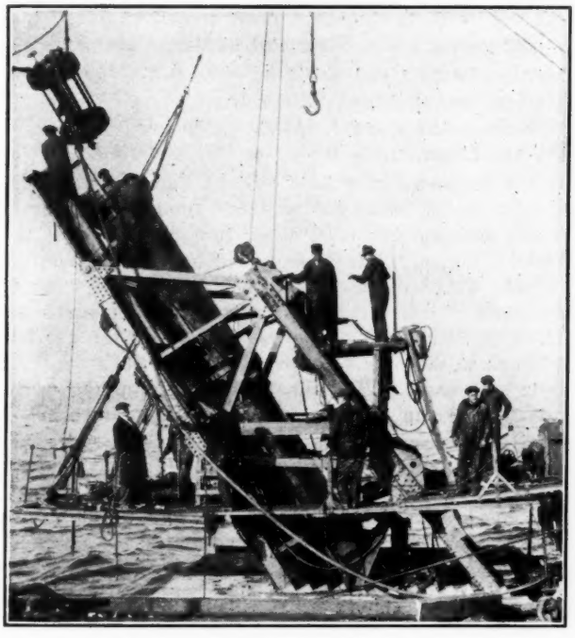
The photographs with the explanations accompanying them show clearly details of plan and operation.

THE SKIDWAY *for laying the submerged pipe after lifting from the water for the winter of* 1914-15, *looking toward the upper end. The growth on the framework of the skidway is a brownish seaweed about* 1½ *inches long.*

The side guide rails run just below the level of the boy's shoulders.

The cable shown runs from the deck of the pipe-laying boat to the lower end of the skidway and is under strain while moving ahead.

THE JOINT *has been finished and the testing bulkheads are being lowered into the pipe, preparatory to applying water pressure on the joints. Note the attachment of the cables for lowering the pipes on the skidway, seen just behind the bell.*



GAS AND ELECTRIC STREET LIGHTS

A COMPARISON OF COST AND EFFICIENCY

This report of a comparative street test of high-pressure gas and flame-arc electric lighting of sections of two streets under similar conditions was made in an English city and prices for gas and current may be different from American prices, but the results are given in such form that the necessary corrections for any particular case can be made readily and the comparison made for any city with any ordinary prices for gas and electricity.

IN ORDER to obtain reliable data for future guidance in designing street lighting systems, the corporation of one of the great English towns, with a population of over 750,000, instituted a test between two main thoroughfares, one lighted by electricity and one by incandescent gas.

Two experts, one in electricity and one in gas, to make an exhaustive trial and to report on the results; those obtained are detailed below. The two experts presented separate and to some extent antagonistic reports. On two points the experts agreed: 1. That for all practical purposes the degree of illumination in the two thoroughfares is approximately equal. 2. That based upon the figures of costs of current and gas, given them by the respective departments, the arc lamps as used in one street, are provided at an annual cost, which is less than the gas lamps used in the other street.

For the purpose of the test a length of Portland street was selected, lighted by four electric lamps, and a length of Princess street, lighted by four gas lamps; this arrangement was adopted so that a similar number of lamps and length of street could be dealt with in each case.

The methods of testing and the principles upon which they depend were described in an article in MUNICIPAL ENGINEERING, vol. xlvii, p. 235.

In the cases of the two thoroughfares, the lighting of which was critically studied, the method adopted was by the erection of central light sources suspended from span wires. In the case of the street lighted by gas, the sources of light consisted of Keith High-pressure gas lanterns, each containing three inverted high-pressure mantles supplied with gas from the municipal gas supply, raised to a pressure of 55 to 60 inches of water, by means of a compressor plant placed in a convenient central position, the pumps being driven by electric motor, supplied with power from the municipal electricity station. In the electrically lighted street the same method of suspended sources of light was adopted; they are of the type known as the metroplane magazine flame arc lights, with clear inner globes and partially obscured outer globes. These lamps, of which there are sixteen, are connected eight in series, across 400 vilts obtained from the ordinary distributing sietroor R, supplied by the municipal electricity undertaking. Each lamp takes an average of 583 watts. The circuits are so arranged that every alternate lamp can be switched off, when it is desired to reduce the illumination, after the traffic has ceased for the night.

Both for gas and the electric lamps a tower ladder was used, when it was necessary to adjust, trim and clean the lamps. In the case of one of the streets, that did not interfere with the tramyay traffic, as it runs only one side; but in the street lighted wtih gas lamps, the tram service was held up. Lowering the lamps would in that case have been resorted to, by means of special lowering gear, but it often proves unsatisfactory and was, therefore, not used; consequently when the lamps required attention during the hours of traffic, the tram car service had to be interrupted.

In the two streets under review the sources of light, or lamps have not been erected at equal distances apart, obviously due to the difficulty of obtaining wall fixings at the exact points necessary for such equal distances. The gas lamps in the one street vary in heighth and distances apart as shown below:

No. 1 lamp, height 25 ft., 10 inches.
No. 2 lamp, height 26 ft., 1 inch.
No. 3 lamp, height 27 ft., 3 inches.
No. 4 lamp, height 27 ft.
Average height 26 ft., 6 inches.

Horizontal distances:

Between 1 and 2, 104 ft., 10 inches.
Between 2 and 3, 118 ft., 6 inches.
Between 3 and 4, 98 feet, 6 inches.
Average, 107 ft.

The arc lamps in the other street are all 27 feet, 6 inches above the paving. The horizontal distances are:

Between lamps 1 and 2, 132 ft.
Between lamps 2 and 3, 116 ft.
Between lamps 3 and 4, 114 ft. 7½ inches.
Average distance, 121 ft.

As the distances vary it is obvious that the actual minimum illumination would not be a fair comparison, therefore, the mean distance has been taken in each case, that is for the electric lamps, 121 feet apart, and for the gas lamps, 107 feet apart. These distances have also been taken when computing costs. Thus in the case of the electric lamps there would be 43.6 arc lamps to the mile, and with the gas lamps 49.34 lamps to the mile of street.

As in both cases the illumination at the minimum position is derived from the rays eminating from the lamps between the angles of 20 and 25 degrees from the horizontal, and in the case of minimum illumination from the rays at 45 degrees from the horizontal; therefore, the bulk of the photometric measurements were made at these angles. In order to ascertain the illumination which actually results in practice, photometric tests were made from time to time over a period of eight weeks, and nightly record was kept, and all failures, extinctions, and other details were noted and are detailed below. The results of these very numerous light measurements can be condensed as follows:

1. Average candle-power at 20° to 25° from horizontal.
2. Average candle-power at 45° from horizontal.
3. Average minimum horizontal illumination derived therefrom on the pavement.
4. Average maximum horizontal illumination derived therefrom on the pavement.

The averages obtained by actual measurement were as follows:

Candle-power at 20° to 25°.....	1,750 c.p.	2,970 c.p.
Candle-power at 45°.....	1,670 c.p.	3,170 c.p.
Minimum horizontal illumination.	.39 ft. c	.5 ft. c.
Maximum horizontal illumination.	1.9 ft. c	2.26 ft. c.

THE STREET LIGHTED WITH ELECTRIC LIGHTS.

THE LAMP USED.

The costs, excluding charges on the lamps and the special mains are made up as follows:

For Gas Lighting—(1) Cost of low-pressure gas delivered to the compressor, plus cost of compressing same. (2) Cost of mantles and renewable parts. (3) Labor charges for lighting, extinguishing and renewing parts.

For Electric Lighting—(1) Cost of current delivered to the street lighting maines. (2) Cost of carbons, glones and renewable parts. (3) Labor charges for carboning, lighting, extinguishing and renewing parts.

Gas Lamps—The cost of low-pressure gas delivered at the compressor station, including manufacture, distribution, rents, rates and taxes, management, interest on loans, as prepared by the municipal officials amounts to 25.38 cents per 1,000 cubic feet. To this has been added the cost of electrical energy for compressing same, which works out at 1.75 units per f1,000 cubic feet, or when charged at 2 cents per unit, at 3½ cents per 1,000 cubic feet, making a total cost of 28.88 cents per 1,000 cubic feet of high-pressure gas delivered into the high-pressure mains.

Carefully made consumption tests carried out on two occasions proved that after allowing for leakage, the consumption per mantle was 25.5 cubic feet per hour, or 79.5 cubic feet per hour for each lamp, thus the cost per hour for high-pressure gas amounts to 2.29 cents per hour; to which must be added the cost of mantles, globes, labor and so on, which has been estimated at 0.56 cent per lamp per annum. The figures are given below:

	Cents per hour.
Gas	2.294
Mantles, etc.	.2
Labor	.36
Sundries	.146
	3.000

To a large extent the labor and maintenance figures have been based on those prepared by the municipal officials, they may be taken as reliable when the lamps are working at the ordinary pressure, but they would be higher should the pressure be increased to improve the efficiency of the lamps.

The tests to obtain the results given below of the flame arc lighting extended over a period of twomonthsandincluded periodic meausrements of electricity consumed to check the electricity meters installed; photometric measurements of candle-power and illumination, carried out every night when the weather permitted; also daily and nightly inspection of the lamps to check consumption, carbons, repairs and so on. Whilst the electric lamps were undergoing the tests, they were operated in a manner usual in ordinary practice. The reflector, also tray and support, were modified in the case of one lamp, to demonstrate that the shadow cast under the lamp can be eliminated. Adjustments and alterations of the lctric lamps were only permitted when found absolutely necessary.

The results obtained from photometric tests continued over a period of two months are as follows for the arc lamps as stated above:

Candlepower at 20° to 25°.....,970 c.p.
Candlepower at 45°..... 3,170 c.p
Candlepower at 20° to 25°..... 2,970 c.p.
Minimum horizontal illumination..... .5 ft. candles
Maximum horizontal illumination..... 2.26 ft. candles

After 11:30 p. m., every alternate electric arc lamp is extinguished, with the following results:

Candlepower at 20° to 25°..... 2,970 c.p.
Minimum horizontal illumination..... 0.084 ft. candles
Maximum horizontal illumination..... 2.26 ft. candles

These figures are the average of all those obtained by actual measurement. The costs, excluding capital charges on lamps and special mains, are made as follows: Cost of current delivered to the street lighting mains; cost of carbons, globes and renewable parts; labor charges of carboning, lighting, extinguishing and renewing parts.

The cost of electrical energy depending, as it does, on the load factor, varies for the half-night lamps, which burn 2,000 hours per annum, and the all-night lamps, which burn 4,000 hours, being 2.14 cents per unit for the former and 1.310 cents per unit for the latter. The average of the electricity meter readings showed that each lamp consumed 583 watts; thus, for one hour, the cost for electrical energy would be:

Half-night lamps—0.583 B. T. units + 2.14 = 1.247 cents.
All-night lamps—0.583 B. T. units + 1.310 = .7637 cents.

To these totals there must be added the cost of carbons and labor. Each lamp contains 14 pairs of carbons, which, during the tests, exceeded five burning hours per pair. These carbons as used at present cost $18.24 per thousand pairs; thus one hour costs 0.36 cent.

Trimming, Cleaning and Maintenance.—Each lamp takes

fifteen minutes to trim and clean. A trimmer and his mate are employed, earning 21 cents and 18 cents per hour, respectively; thus the trimming and cleaning, if cleaned every fifty hours, would be .18 cents per hour. Together with an allowance for repairs and maintenance, this makes a total cost per hour:

	All-night Lamps.	Half-night Lamps.
Electrical energy	0.764 cents	1.250 cents
Carbons	0.360 cents	0.360 cents
Labor	0.120 cents	0.120 cents
Sundries, say	0.156 cents	0.070 cents
Total	1.400 cents	1.800 cents

As lighting and extinguishing are automatically carried out by time switches, no charge has been allotted to them.

The capital cost of plant and apparatus for the arc lamps amounts to $175 per lamp. This amount does not include any sum for series street lighting main. The reason why this is excluded is due to the fact that it has been included in the general charges of the electrical undertaking. The capital cost per mile of street, therefore, would work out at:

43 lamps at $175 = $7,525

The total number of complete extinctions were as follows: One lamp out for 80 minutes; one lamp out for 20 minutes.

As half the arc lamps burn through the night, they are evidently very reliable.

The arc lamps were subjected to the following tests by means of a large number of photometric readings of a twofold nature: (1) Tests of the illumination thrown on the screen of the photometer when placed horizontally and 15 inches from the ground; (2) tests of the candle power of the lamps by direct readings at certain angles.

The photometer was placed on the ground under each of the four electric arc lamps, also at a point in the center of the carriageway, midway between each lamp (taking them in pairs), as well as at a point on the curb midway between each two lamps, so that a line drawn from this point would be equidistant from each lamp. The average foot-candle values were as follows:

UNDER THE LAMPS.

Under arc lamp No. 1	0.87 foot-candles
Under arc lamp No. 2	0.94 foot-candles
Under arc lamp No. 3	0.44 foot-candles
Under arc lamp No. 4	1.26 foot-candles

Mean of above, 0.88.

BETWEEN THE LAMPS.

	On Road.	On Curb.
Between arc lamps No. 1 and 2	.222 f.c.	.231 f.c.
Between arc lamps No. 2 and 3	.27 f.c.	.26 f.c.
Between arc lamps No. 3 and 4	.264 f.c.	.262 f.c.
Mean of above	.252 f.c.	.251 f.c.

The results of the direct candle-power readings are as follows:

	At 20 deg.	At 75 deg.
Arc lamp No. 1	3,034 candles	1,385 candles
Arc lamp No. 2	3,170 candles	1,438 candles
Arc lamp No. 3	2,767 candles	1,759 candles
Arc lamp No. 4	2,826 candles	1,331 candles
Mean of above	2,949 candles	1,478 candles
Maximum c.p. at approximately 20 deg.	3,170 candles	1,759 candles
Minimum c.p. at approximately 20 deg.	2,767 candles	1,331 candles

From careful observations and tests made it was found that each arc lamp consumes 600 watts (0.6 unit) per hour. From this it follows that, taking the light found at an angle of 20 degrees (which may be taken as approximately the maximum), the arc lamps have a mean efficiency of practically 5 candles per watt; from which it may be inferred that the arc lamps were in a highly efficient condition when tested. During the tests striking differences in the results were obtained from the arc lamps, even from the same lamp. This was due to the fact that alterations were made in the shades; one lamp was without a shade thruout the test, whilst a shade was fitted on one during the test. The evident object of fitting a shade is to improve the distribution and lessen the shadows under the lamps. It is doubtful whether electrical experts have quite solved this problem yet, but it is a difficult thing to impart to electric light as perfect a diffusion as can be obtained from high-power gas.

The details of costs of the arc lamps based upon the observations made of the current, carbon and so on, and upon the estimates given by the electricity department of the public authority are given below. In the thorofare under consideration, which has a width of 66 feet, there are sixteen arc lamps, four of which were subjected to the tests described in this article.

1. Cost of current, $36.12 per k.w. of maximum demand, plus $1.11 per unit metered (running cost).
2. Carbons, $18.24 per thousand pairs.
3. Wages trimmer, 21 cents per hour; mate, 18 cents per hour.
4. Eight lamps (all night), run on 45 per cent. load factor, equal to 4,000 hours per annum.
5. Eight lamps (half night), run on 23 per cent. load factor, equal to 2,000 hours per annum.
6. Cost of current (all night), 1.364 cents per unit.
7. Cost of current (half night), 2.264 cents per unit.
8. One pair carbons lasts 4½ to 5 hours.
9. Lamps are trimmed about every 45 hours and 2 hours are taken in trimming 8 lamps.
10. Each lamp consumes 600 watts per hour.

All-night lamps 45 per cent. load factor. 60/100 by 4,000 equals 2,400 units per annum.	Cost per lamp per annum.
Current, 2,400 by 1.364 cents	$32.74
Carbons at 0.4 cent per hour—4,000 at 0.4 cent	16.00
Trimming at 0.14 cent per hour—4,000 at 0.14 cent	5.60
Total per lamp per annum	$54.34

Equal to 1.36 cents per hour lighted.

Half-night lamps 23 per cent. load factor. 60/100 by 2,000 equals 1,200 units per annum.	Cost per lamp per annum.
Current, 1,200 by 2.264 cents	$27.16
Carbons at 0.4 cent per hour—2,000 at 0.4 cent	8.00
Trimming at 0.14 cent per hour—2,000 at 0.14 cent	2.80
Total	$37.96

Or 1.8 cents per hour lighted.

Nothing is included in the above costs for interest and depreciation on capital spent on installation or general maintenance charges, also not for globes and so on.

CAPITAL SPENT ON INSTALLATION OF THE 16 ARC LAMPS.

Mains to foot of poles or pipes	$1,480
Wages, fixing lamps, etc	456
Arc lamps, poles, wire, carbons, hangers, etc	1,656
Meters	24
Cost of erecting side poles, wall rosettes and span wires.	624
Total	$4,240

It must not be assumed that the same lighting efficiency of 5 candles per watt can be obtained from any 11-ampere arc lamps as furnished by the makers. The experience of experts is that from 3 to 3½ candles per watt is the maximum duty to be obtained. It should also be noted that if smaller lighting units are required (7 or 8-ampere lamp) the efficiencies are still lower.

MARKING SAFETY ZONES

ON BUSY STREET CROSSINGS

By James F. Hobart, M. E., Indianapolis, Ind.

The problems of parking of automobiles and management of street traffic, especially at busy intersections, are still in process of solution. They are closely connected and overlap occasionally. This article describes the rather elaborate system which is now in operation in Indianapolis and shows some of the mistakes in the installation and the corrections made. After a very few weeks of operation traffic has become accustomed to the crooked and narrow ways to which it is confined in order to separate foot and vehicle classes and the system is in successful operation.

THE system of street marking which has been in use at the principal street crossings in Indianapolis for several weeks seems to help not only the pedestrian, but the motorman and also the automobile driver. But, like some other good things, they seem to be carrying it a bit too far and adding a lot of posts and chains to the markings.

The safety zone system consists of broad white lines painted upon the pavement to indicate where vehicles may and may not go, where pedestrians may not go, and where they may stand and wait in safety for the street car. And the markings also show to the motorman just where he must stop his car and not encroach upon the foot passengers' territory at street crossings.

The markings are indicated by the double lines in the cuts. White paint is used for them and the lines are made about 4 inches wide. The lines forming a square around the street intersection are first laid down, following the curb lines across the streets, but are rounded at the ends, so that instead of intersecting the curbs, the lines join each other by means of a short curve, about 2 feet from the curb, the corner of which is also rounded. Inside these lines no foot passenger has any business whatever, and the traffic policeman has that square for his exclusive territory, save for the wheel traffic from every direction.

Next, lines are laid down which are continuations of the building lines as found upon the several streets. These lines begin at the curb on that side of the street where the cars do not stop, and run on the building line direction, past the middle of the streets, and stop at the last rail of the last car track in that street. Some streets are marked with these lines extending clear across from curb to curb, but to the last rail of the car track seems the better way.

A space several feet wide is marked off along the car track, on the "near" side of the street, and this space is the safety zone, to provide and protect which the system of lines has been worked out. The safety zone extends along the track, between it and the painted parallel line seen in the photograph, as far as the traffic demands. Some of the safety zones are longer than others. The length is made according to the amount of traffic found at any corner. The zone is made one car length, also for two cars, and in some places three cars long.

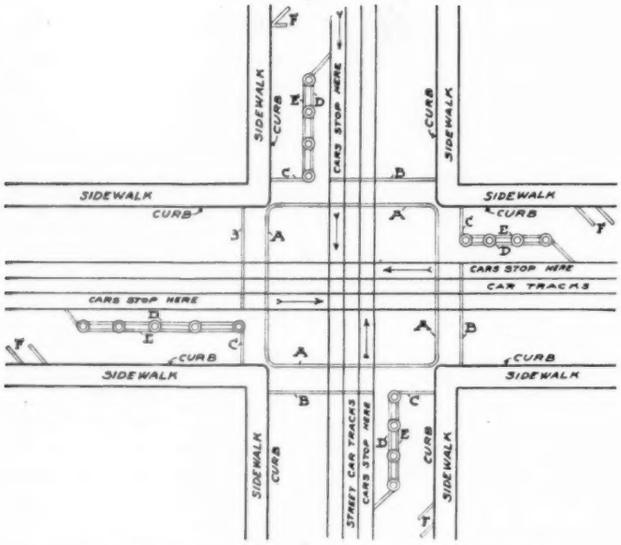
The painted line on the building line is carried from the safety zone space until it reaches the curb on the "near" side of the street. The foot passenger now has a straight, clear right of way from one side of the street to the other, and with a way into the safety zone from which he may step into a car.

The two lines shown in the photograph of the safety zone are about 18 or 20 inches apart. The inner line was first laid down 6 feet from the track, as the limit of the safety zone, but they did not count on the overhang of the car, so they had to draw new lines 6 feet from the side of a car. The inner lines will not be renewed, and, as shown in the photograph, are becoming faint and will soon disappear. At the far end of the safety zone in the photograph is seen a diagonal line which extends to the car track. Automobiles coming along the street necessarily are obliged to keep pretty close to the car track on account of the parking of automobiles along the curb. To give room for automobiles to pass the space occupied by the zone of safety, two short diagonal lines are drawn from the curb opposite to and parallel with the diagonal line, limiting the end of the safety zone. These lines mean to the automobile driver that he must not park his car between those lines and the corner. This means that automobiles will always have plenty of room to swing toward the curb when they come to the zone of safety, with no parked machines there to trouble them. It also means to the pedestrian that he can at all times cross from the curb to the zone of safety without having to squeeze thru between parked automobiles. This, however, is something which the police department did not count upon, for foot passengers are supposed to walk down between the lines extending the curb and building lines across the street until they reach the zone of safety. But it does not work that way, and when a street car comes along, the people flock to it across the automobile space and dodge in and out between the cars which are being held up by the traffic officer while waiting their turn to cross the intersecting street.

The painted line on the building line forms a deadline for automobiles. They are expected not to run past that line until permitted by the officer. And I watched them many times, to notice each time a car ran past line C a little, that a wave from the officer's hand was always forthcoming and the offending car backed off the line.

The line is also a deadline for trolley cars about to stop for passengers. The motorman has found that it was decidedly unpleasant to run past this line, for the corner policeman always notices it, and if the car doesn't back up, the number of the car goes into the officer's notebook and the motorman hears about it next day from the police department.

Thus far, the Indianapolis safety zone business seems all to the good and fair to footmen, automobiles, wagons and street cars, but here is where the system may be carried too far. On the boundary line of the safety zone are several small circles, from 18 to 24 inches in diameter and 12 to 20 feet apart. These circles are occupied by cast-iron bases, as seen in the photograph; made very heavy so they will not overturn easily. A pipe post extends upward about four or five feet and is terminated by a "cross," thru which a chain is passed and made fast on the end post and one or more if the intermediates. This chain is stretched the entire length of the zone of safety, and is supposed to prevent people from getting into automobile territory and to keep automobiles off the zones of safety.



PLAN OF SAFETY ZONES *at an Indianapolis street crossing. A, B—White bands to keep foot traffic off the intersection and street in block between crossings.*

C—White bands defining stopping place for vehicles until semaphore or policeman shows crossing open.

D—Line defining safety zone for street car passengers, which was too close to car and was moved to E. Along E are set posts with chains, as shown in photograph.

F—Lines defining end of parking space for vehicles in the block and fixing passageway for moving automobiles, which must turn from their line of travel along the car tracks at this point to travel along the curb thru the safety-zone region.

The base of this post weighs apparently about 100 pounds. A man can move it easily. In the photograph are shown seven posts and the connecting chain, and I leave it to the imagination of the reader as to what will happen when a man chances to surge against one of these standards, or an automobile goes a little off its course, overruns the mark a bit or skids a little when the asphalt is slippery, and touches one of these post standards. During the first few days of their use posts were tipped over by foot passengers and by automobiles, and posts were even broken by collision of automobiles with them. But experience is a good teacher, and speed is now reduced until such accidents are few and slight. Foot passengers also learned promptly that they could not lean against the posts with impunity.

There are other features of the automobile control system in Indianapolis which do credit to the police department, and among them is the scheme for marking the fire hydrant locations. In the business section some fire hydrants are below the surface of the street, and a cast-iron cover plate must be raised to permit access to the fire connections. Wherever one of these hydrants is located there will be seen a couple of oblique lines extending from the curb into the street. Whenever a set of these lines is found, it tells the auto driver not to park his car between those lines, as there is a fire hydrant there.

The driver is further warned by an "Order of Police Department' 'signs, placed on the curb opposite the fire hydrant. This sign reads, "Fire Hydrant, Park No Cars Here. Order of Police Department."

These signs are very neat, consisting of a cast-iron base, with pipe standard and sheet-iron oval signboard. They are about four feet high. The base is heavy, to prevent upsetting, but is much lighter than the zone sign base and about ten inches in diameter. There are several varieties of this curb sign, such as "Park No Cars on This Block," "Park Cars Here," "School House, Run Slow," etc.

It is nothing out of the ordinary to see ladies cross anywhere they wish, sometimes on a long diagonal from the opposite side of the street to the farther end of the safety zone. The police board has been given rules which put pedestrians under police regulation as well as teams and automobiles, and compel the foot passengers to stop and obey the crossing signals the same as the wheel traffic; nevertheless, foot traffic is very lawless and a menace to its own safety.

One very good arrangement is in force at Indianapolis street crossings in relation to the fire department. When ever the fire automobiles come charging down, the traffic officer blows three blasts upon his whistle, and everything stops or clears the street forthwith. The fire department co-operates with the police in this matter by the installation of electric bells at all street corners where traffic officers are necessary.

When a fire alarm is turned in, these street corner bells are set a-ringing in advance of the fire apparatus, so that vehicles have ample time to clear the track.

The police department is placing at street intersections the semaphore stand and target on the stand of the traffic officer. With this new instrument, the officer need not blow his whistle, one blast to start north and south traffic, two blasts for east and west movements. He only needs to turn the semaphore and the sign "Stop—Stop" does the work for one direction, while the words "Go—Go" on the other target take care of the crosswise travel.

SAFETY ZONE *for street car passengers, showing the lines D and E of the diagram and the posts, signs and chains to emphasize line E. A similar post with base and a semaphore, lettered "Stop-Stop," "Go-Go," stands by the traffic policeman near the center of the intersection, and signals the traffic to wait or to proceed, aided also by the policeman's whistle and arm in case of slow, impatient or inattentive drivers.*

Water Purification in Columbus, Ohio.

After some years of experiment on small and on large scales, the water works plant of Columbus, Ohio, has succeeded in reaching very satisfactory solutions of the problems involved and has used some methods not heretofore applied to this class of work. This enumeration of the features of the plant, brief description of some of them, and statement of recent results is taken from papers and reports by Charles P. Hoover, the chemist in charge of the plant, and is of much interest and value.

THE water purification plant at Columbus, Ohio, has many features which have not been used heretofore on the scale required in a plant for treating a municipal plant, and some novel combinations have been made to improve the acceptability of the water to users, to increase efficiency and to reduce cost. These various features have been the subject of articles in MUNICIPAL ENGINEERING and elsewhere, and Charles P. Hoover, the chemist in charge, has prepared a description of the whole plant for the Ohio State Board of Health from which this brief statement of the component parts of the plant is taken. Mr. Hoover's annual report for the year 1914 is also drawn upon for data as to the results of operation of the plant.

The problems solved by the water purification plant and to be solved by future improvements in it, have been and are more than usually difficult for a public water supply, though small supplies for Indianapolis and factories have been the cause of the development of most of the methods of treatment which have been applied to the Columbus problem with such modifications as the size of the plant and the difficulties in details of conditions have required. The genius of those responsible for the original designs and especially for the modifications of them in practice, and the additions to them is evidenced in the readiness with which they have made applications and combinations, the ingenuity with which they have made the necessary modifications and designed the necessary details of apparatus, and the ultimate success of their efforts, sometimes under great apparent discouragement.

The Scioto river, from which the city's supply is taken, is rather seriously polluted with sewage. The water in the river is at times excessively hard, and the watershed is of such a nature that rains frequently make the river water extremely muddy. The differences in rainfall and in the seasons of the year make the river very irregular in its flow, and consequently, very irregular in condition and in the constituents of the water. Local rains on watersheds of the streams tributary to the river of different characteristics add still further to the confusion.

With almost hourly variations in quality of water, a most detailed watch of it must be maintained, and, to secure the best results, equally frequent modifications in the method of treatment must be made.

Before the installation of the purification plant the death rate from typhoid fever in Columbus was 139 per 100,000 deaths. In 1914 it was 13.68, or less than one-tenth of the former enormous rate. To demonstrate that this residuum of typhoid mortality is not due to the city water supply, Mr. Hoover shows that eight of the twenty-seven deaths of residents in 1914 from typhoid fever, occurred in August and that during that month the average showed but two bacteria per cubic centimeter in the filtered water and during July was but three. Also the B. Coli index, which indicates the possible remainder of the original sewage pollution in the untreated river water, was lower than in any other month of the year.

The turbidity in the river is at times so great that as much as 250,000 pounds of mud has been removed from a single day's supply. In parts per million the maximum has been as great as 2,000. In 1914 the yearly maximum turbidity is reported as 850 and the minimum as five. It was less than twenty-five for 73 per cent. of the time, though the average turbidity for the year was fifty-four.

The monthly averages of the raw water as taken into the filteration plant show maximum turbidity of 337 and minimum of five. The maximum turbidity of the filtered water was 119 in February and the turbidity was zero for the last seven months of the year.

During 1914 the total hardness of the river water averaged 297 parts per million, which was reduced to seventy-nine in the softened and filtered water.

The maximum average number of bacteria in a cubic centimeter in any one month during 1914 was 27,337, the average for the year was 6,331, and the minimum was 216.

The maximum monthly average of bacteria in the filtered water was eighty-one, the average for the year was fourteen, and the minimum was none.

The purification system which produces these results begins with a reservoir 5.8 miles long and 500 feet average width with capacity of 1,720,000,000 gallons, formed by a concrete dam across the river, 1,000 feet long and thirty feet high, illustrated description of which was published in MUNICIPAL ENGINEERING some years ago. A partial sedimentation takes place in this reservoir.

The raw Scioto River water which passes either over the dam or thru large gates which are provided in the dam, passes down the channel of the river to the intake at the purification works. The intake is protected by means of large screens which serve to prevent the entrance of sticks, leaves, or other floating particles which would seriously damage the pumps should they be drawn into the suction line. The water passing the screens enters a suction well from which it is lifted by a pump and forced thru a meter into the receiving compartment at the purification plant. Chemical solutions, lime, soda ash and alum of known strength or concentration are prepared and stored in large chemical solution tanks. Proper quantities of these chemical solutions for softening and purifying the water are measured by special measuring devices and discharged into the water as it enters the receiving compartment. After the addition of the chemical solutions it is very necessary that the chemicals and water be thoroly mixed. This mixing is accomplished by passing the water thro baffled mixing chambers. The mixing chambers may be described as a series of dams over and under which the water is made to pass. At the Columbus plant the water travels approximately one mile over and under these dams in a period of about two hours. During the time the water is passing thru this mixing chamber the chemical reactions between the chemicals added to the water and the mineral salts originally present take place. The precipitate is insoluble material formed by these reactions and is a heavy gelatin-

ous mass. It entangles itself with the mud, bacteria, and other impurities in the water. This mixture is heavy and is easily removed. Much is removed by allowing the water to circulate slowly thru large settling basins. The heavy gelatinous mass settles to the bottom of these basins or tanks from which it is periodically washed into the river at a point below the intake. The water from the top of the basins is drawn off continuously and filtered thru sand beds into a large receiving basin or filtered water reservoir.

The filter is a concrete box in the bottom of which is a strainer system. The strainer system consists of a number of small brass plates perforated with small holes. The strainers are covered with gravel which is placed in four layers graded in size, the coarsest being at the bottom. The gravel supports the sand which has a thickness of 30 inches. When a filter bed is in service, that is, when the water is filtering thru it, the water passes downward thru the sand. All the mud, impurities, suspended particles and practically all of the bacteria are caught or retained on the surface of the sand bed, and the water coming from the filter is sparkling, clear and pure. After a filter has been in service 24 or 48 hours it becomes necessary to clean the bed and this is done by forcing the water upwards through the strainer system. The water comes up thru the openings in the strainer plates, up thru the gravel and sand, and the mud and impurities on the surface of the bed, being lighter than the sand, are floated in the rising wash water and are overflowed into a drain and are allowed to flow back into the river. The entire filter bed having an area of 1,080 square feet is washed perfectly clean in five minutes.

The city maintains a complete chemical and bacteriological laboratory at the water purification plant, where the water is tested chemically every two hours day and night, Sunday and holidays, and bacterial analyses are made daily on samples collected at the plant and from different points on the distributing system. Daily bacteriological tests are made in the laboratory of the Ohio State Board of Health and at the city board of health. There is a chemist to control the operation of the plant and attendants for plant operation are on duty every hour of the day and night.

Every day during the year 1914 the water softening and purification plant softened and purified an average of 18,400,000 gallons of water. This was sufficient for a per capita consumption of 88 gallons per day. The expenditure for chemicals for treating the water during 1914 was $83,826, divided as follows:

Lime, 4,650 tons at average of $5.27 per ton.
Soda ash, 3,540 tons at average of $13.30 per ton.
Alum, 880 tons at average of $16.75 per ton.

Lime and soda ash are used to soften the water. At first consumers felt that the use of chemicals for softening and coagulating the water would not be desirable, and had some hesitancy in using the chemically treated water. This prejudice has been entirely overcome and the people are now beginning to realize that there is less chemical in the filtered water than there is in the raw river water, the reason being that the chemicals which are added to the water in order to soften and coagulate it combine with the soluble carbonates and sulphates present in the raw water and form insoluble compounds which are removed from the water by sedimentation and filtration.

It has been learned at the Columbus plant that the addition of lime to water not only softens the water, but that the typhoid and other intestinal bacteria will not live in lime-softened water, because the lime absorbs the carbonic acid from the water, and these disease-producing bacteria will not live in water free from carbon dioxide.

If the lime-softened water be inoculated with typhoid organisms they will die out in a period of from 20 to 24 hours, and if the water be softened to the lowest possible figure with lime, and an additional quantity of lime added sufficient to introduce a small quantity of excess lime, the sterilization is much quicker, from 4 to 5 hours.

When sulphate of alumina is added to a muddy alkaline water the aluminum combines with the alkalinity of the water and a flocculent, gummy, gelatinous precipitate of aluminum hydroxide is formed. The precipitate entrains the mud and bacteria and all suspended particles present in the water, and being heavy it soon settles. This settling process or sedimentation takes place in large concrete settling basins. The material which settles from the water is washed from the settling basins back into the river, below the intake.

A new plant has been recently installed and put in operation for making alum. it is the first plant of its kind ever built, and the Columbus plant is the first to make its own alum for purifying water. Calculating on the basis of 1914 consumption of alum imported, the saving to the city will approximate $6,000.00. The plant cost approximately $12,000.00, therefore, in two years the new plant will pay for itself.

The cost of making alum in this plant is approximately $10.00 per ton. The cost of imported alum during the past six years is shown in the following table:

Years.	Cost per ton.
1909	$19.00
1910	18.00
1911	17.50
1912	17.15
1913	17.10
1914	16.75

During the year 1914, 880 tons of alum were used.

Aluminum sulphate syrup is made by heating bauxite (a high aluminum clay) and sulphuric acid together, and applying the resultant sulution without filtering, concentrating or crystalizing, to the water to be treated. The insoluble silica present in the alum syrup mixes with the mud in the water under treatment, and is entrained by the precipitated aluminum hydrate and settles out in the sedimentation basins.

The following tables make numerical comparisons of the results of operation of the plant since the first full year of its work. As already stated improvements have been made each year, which have had an evident tendency to increase the efficiency of the plant. Some have been made for the purpose of reducing the cost of operation, like the alum making plant, so that the cost of operation in future years should show a diminution below that of the past.

Year.	Million gallons softened and purified per 24 hours.	Reduction in Hardness; results in parts per million.		Removal of Bacteria average total No. per cc.	
		Raw Water	Filtered Water	Raw Water	Filtered Water
1909	14.3	253	93	9,235	120
1910	15.5	270	85	9,338	24
1911	15.6	245	84	11,470	55
1912	17.5	222	79	19,210	14
1913	18.3	271	88	6,310	15
1914	18.4	297	79	6,331	14

Flood Prevention Plans for Dayton, Ohio.

By William S. Crandall, Dayton, Ohio.

Altho the flood which did so much damage to the city of Dayton, Ohio, and her sister cities farther down the Miami river took place in March, 1913, *the city is only just now in position to begin actual work. Legislation, plans for financing, detailed surveys and plans, and especially legal proceedings to form conservancy districts and to test the constitutionality of the law and the legality of proceedings, take much time, and the city will be well pleased if it sees actual construction in progress at the end of three years after the disaster. This paper by an observant resident of the city tells what has been accomplished at the present date, and will aid those who attend the October convention of the American Society of Municipal Improvements to understand what they will then see and hear upon the subject of Dayton's great problem.*

THE flood that engulfed the Miami valley during the last days of March, 1913, was a calamity of large proportions. It caused the loss of hundreds of human lives and the destruction of millions of dollars worth of property. It dealt a staggering blow to nearly a score of cities, towns and villages, besides laying waste thousands of acres of fertile lands. It was a calamity unparalleled in the history of the locality.

The property loss for the entire flooded district, as estimated by the special board of engineers, aggregated $67,383,574. Of this amount, Dayton lost more than two-thirds, or $47,254,200. It is not surprising, therefore, that the Gem City should be the first to think of and propose flood prevention plans.

Before the waters had subsided from the streets a citizens' relief committee was appointed by Gov. James M. Cox. The membership of this committee was later increased to forty, including citizens from other parts of the flooded district, and renamed the Dayton flood prevention committee. In less than two months from the date of the flood, under the leadership of this committee, a campaign for raising a flood prevention fund was conducted for one week. More than 23,000 men, women and children of Dayton contributed more than $2,000,000 for this purpose.

Wise plans were evolved, covering the legal, legislative and engineering phases of the problem. While the work has been pushed with all possible speed, nearly two years and a half have been required to complete the plans, owing to the obstacles raised, principally by those who lived outside the flooded district. Finally, the way has been cleared and the preliminary plans for actual construction will soon be put into effect.

The task of framing legislation that would adequately provide for the exigencies of the situation, so that while the lives and property of the inhabitants of the district would be safeguarded the means employed therefor should be just and equitable to all concerned, was herculean. Great as it was, the end has been achieved, and the efficiency and permanency of the undertaking has been assured by the lawful creation and organization of the Miami conservancy district.

Before the conservancy district could be definitely outlined and the creative act framed, a vast amount of engineering data was absolutely necessary. The Morgan Engineering Company, of Memphis, Tenn., was retained by the committee for this purpose in May, 1913. Arthur E. Morgan, of this firm, has given the work his personal attention most of the time since. He has been ably assisted by John W. Alvord, of the firm of Alvord & Burdick, of Chicago; Daniel W. Mead, professor of hydraulic engineering, of the University of Wisconsin, and S. M. Woodward, professor of hydraulics, of the State University of Iowa, Iowa City, Ia.

Under this organization an immense amount of work has been accomplished, including surveys of nearly the entire flood plain of the main stream, surveys of seven reservoir sites on the main stream and tributaries, investigations, including estimates of cost, of the practicability of channel enlargement and of flood control thru the agency of reservoirs, and an exhaustive study of the storm of 1913 and researches as to other storms and the liability of their recurrence.

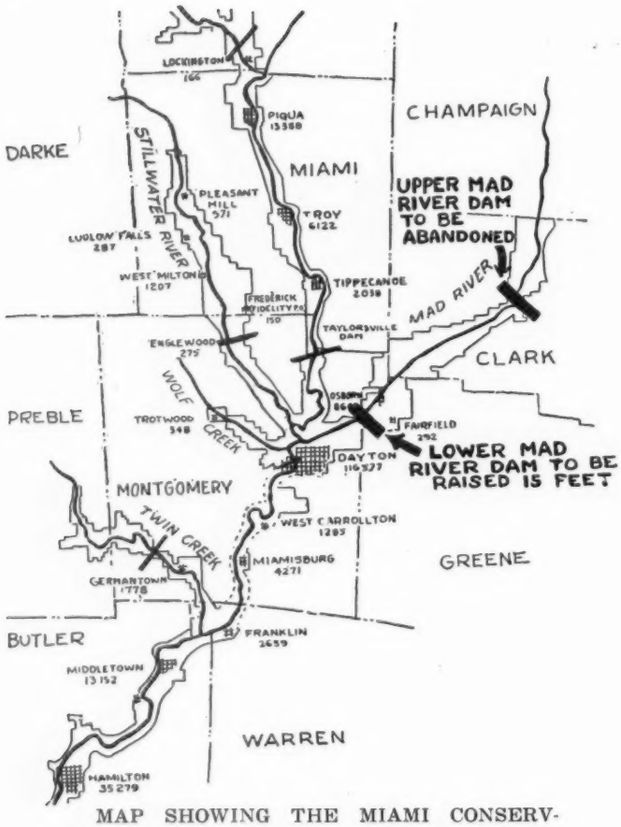
The board of engineers considered the merits of two general methods, distinct in principle from each other, as related to the problem in hand. The first, by the enlargement of channel cross-sections by dredging, deepening, widening, and the removal of obstructions or the construction of levees was, in the opinion of the board, impracticable in this instance. The second, by the use of detention basins, was adopted by the board as the one which was better adapted to the needs of the Miami valley. This plan has been fully outlined in the extensive report of the board, from which the following is quoted:

"The term 'detention basin' is used because the ordinary functions of storage reservoirs will not be utilized in connection therewith; that is, the dams will not be used for the permanent storing of water for power, domestic supply, irrigation, navigation, or other similar uses. The basins will be used solely for the purpose of flood prevention, and the water will be detained therein only for short periods, and will be allowed to run out as rapidly as can be done with safety to the valley below. For this reason, their use is solely that of detaining the crest of floods for short periods.

"The board favors the use of earth dams for making the detention basins, as those are best suited to the topographical and geological formations.

"A dam without masonry or concrete core walls, and having grassed slopes, is the type naturally suited to the conditions. A method of construction frequently adopted under similar conditions, termed the modified hydraulic-fill method, contemplates the use of the excellent local morainal or glacial drift found at or near each of the sites. In this method low earth embankments would first be built up near the upstream and downstream toes of the proposed dam, the materials in the embankments being dumped in place from cars. The inside slopes of these embankments would then be sluiced or washed down by streams of water, filling the basin or trench between the embankments and forming a core of clay, sand and rock dust that will be impervious to water.

"A spillway of ample proportions, well below the crest of each dam, should be excavated in and founded upon solid rock, where possible, sufficient to pass the flood flow of the stream.



MAP SHOWING THE MIAMI CONSERVANCY DISTRICT, *being the areas set off by the lines on each side of the principal streams. The locations of reservoirs which will ordinarily be dry, and the soil in them cultivated, are shown by the heavy lines across the streams. These dams become operative only in case of heavy floods, when they hold back, but do not completely stop, the flow, and thus distribute the flow over longer times and prevent the massing of water, which produces the great damage. A recent modification of the plans, cutting out one dam and raising another, is shown by very heavy lines and explanation in bold-faced letters. This removes a source of danger to the city of Springfield above and makes it necessary to purchase all the property in the village of Osborn, just above the dam whose height is increased.*

The spillway channel should be protected from erosion and should discharge sufficiently far below the dam to prevent damage thereto.

"The outlet conduits should, where possible, be taken out in tunnels thru the natural hill formations and discharge into the stream at a safe distance below the dam. When not practicable to use this construction, a solid foundation should be secured.

"The outlets of the basins will be permanently open and will be of such capacity that the ordinary flow will pass without any accumulation behind the dams; but in time of high water the surplus, after the discharge reaches a certain stage, will be detained in the basins, and the overflow will be regulated to an amount that can be safely carried away. The quantity of this discharge from the different basins will vary, some requiring a relatively greater outflow than others to prevent the basins filling too rapidly. The operation of the outlets will be entirely automatic; that is, it will not be by means of gates nor subject in any way to human control. Accumulations of water behind the dams will quickly run out after the period of high inflow passes, and the basins will be empty nearly all the time. Based on the history of past storms, it is not probable that they will fill to their capacity more than once or twice in a century. The accumulation of water in the basins, when it does occur, will serve the useful purpose of collecting soil wash from the watershed and depositing it upon the land within the basins.

"Inasmuch as a sense of insecurity is often felt by those who live in valleys below great dams, the board takes this occasion to express its opinion that these proposed dams will be made perfectly safe by following the established rules of engineering experience in their construction.

"The operation of the detention basin system has been worked out with considerable care and checked by several members of the board, both in its application to the flood of 1913, and, in an approximate manner, to one about 20 per cent. greater. From these determinations it appears that during the flood of 1913 the flood peak at Piqua would have been reduced from about 85,000 to about 45,000 second feet; at Dayton, from 257,000 second feet to about 65,000 second feet, and at Hamilton, from about 329,999 to about 120,000 second feet. With an estimated increase of 20 per cent. in the intensity of the storm, the controlled peak at Dayton can be reduced from about 307,000 second feet to perhaps 80,000 second feet.

The latest developments in the flood prevention plans for the Miami valley are thus outlined by President E. A. Deeds, of the board of directors of the Miami conservancy district:

"The original plan for the control of Mad river, as developed in the preliminary examination of the valley, contemplated but one detention basin located above Harshman. Final surveys disclosed the necessity of lowering the spillway to avoid the necessity of back water in Osborn under extreme conditions. This reduced the capacity of the reservoir and made necessary the locating of a second basin on the upper Mad river above Buck creek.

"Some of the leading citizens of Osborn were familiar with this situation, and approached the board of directors of the Miami conservancy district with the suggestion that the district acquire the property in Osborn. The whole subject was given consideration, concluding with the adoption of the suggestion as made. Accordingly property owners in Osborn are giving long-time options to the district. It is a plain, commonsense, business proposition. The residents of Osborn will be fairly paid for their property, and the district, on the other hand, will make a substantial saving by the omission of the upper Mad river reservoir.

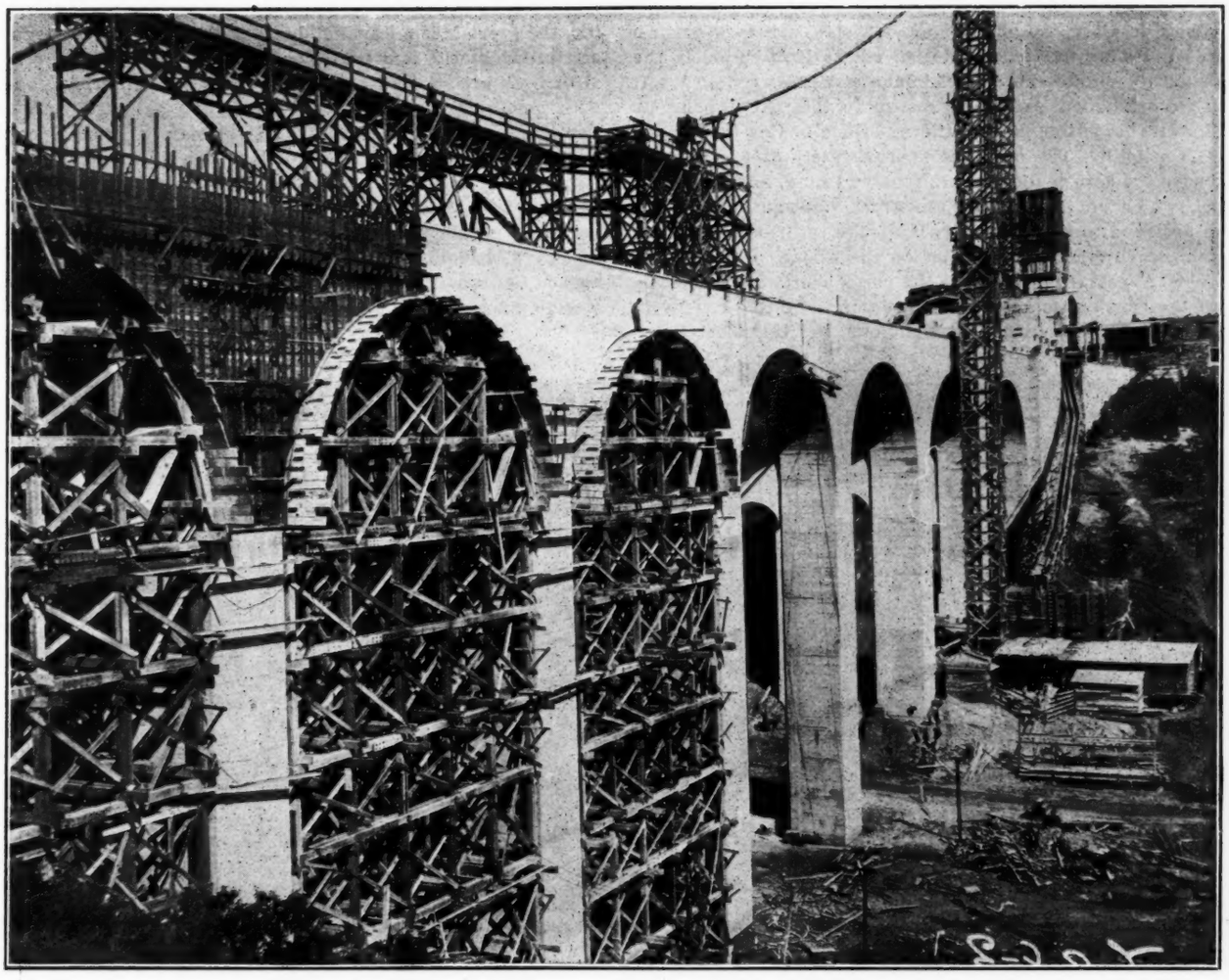
"We are building for centuries to come, and, looking at it from the broad viewpoint, good sense would dictate the purchase of Osborn as the wise thing for the district as well as for the residents of the village itself."

In consequence of this change of plans, the upper Mad river dam, to which the people of Springfield objected, will be abandoned, and the lower dam on the Mad river below Osborn will be raised 15 feet. Under this new plan, in the event of a big flood, Osborn would be under 15 feet of water."

This situation left but one thing to do—buy the entire village of Osborn—and this will be done. There are approximately four hundred pieces of property in the village, all of which will be purchased.

The upper Mad river dam near Springfield would have cost about $2,500,000. The Osborn purchase plan and the cost of raising the lower Mad river dam 15 feet will amount to about $1,500,000, so that the net saving will approximate a million dollars.

The total cost of the flood prevention improvements, as estimated by the board of engineers, will reach $17,000,000.



CONCRETE VIADUCT AT SAN DIEGO.

THE accompanying illustrations show the construction of San Diego's remarkable concrete bridge. The visitor to certain world's fairs of previous years recalls the unsightly approach over railway tracks and through such sections of town as were far from ornamental. When San Diego started building the Panama-California Exposition there was chosen the great 1,400-acre Balboa Park, along the sides of which are some of the best residential districts of the city.

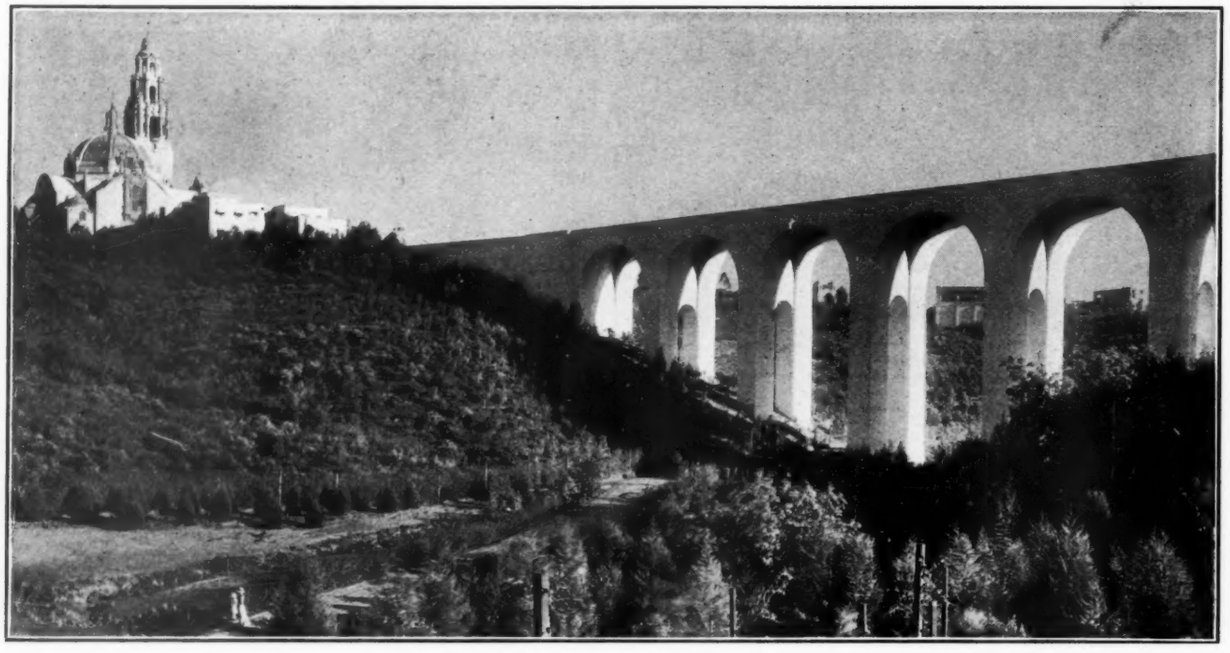
It may be stated that there are two main approaches, one winding slowly up from down town, along the edge of a broad canyon, the other directly across the deepest point of the great Canyon Cabrillo by the way of a majestic viaduct at the base of which is a shallow laguna and along the supporting piers of which grow trees and shrubs of many varieties. The Panama-California Exposition at San Diego is a monument to Spanish-Colonial architecture. This is true of all the buildings except those devoted purely to amusement purposes. It is equally true of the great Puente Cabrillo, which forms the west approach and constitutes one of the many spectacular features of the grounds. From a distance can be seen the large arches, each of the rounded Spanish type, which appears in the cloisters and arcades and in the doors and windows of the Exposition itself.

This bridge has a total length of 1,010 feet with long approaches leading up to it from the outer gate at the foot of Laurel street, and from the Plaza de California, which constitutes the real entrance to the Exposition proper. The original idea was to build the Exposition at the lower end of Balboa Park, where the spanning of canyons would be unnecessary, but the old plans were revised and it was decided to build the entire city of Old Spain on the highest possible point of the mesa, making fullest use of the adjoining canyons, using the Spanish arch, which, being a descendant of the arch in the old Roman aqueducts, is of the full semi-circular type with comparatively short spans.

As the canyon at this point is 135 feet deep it became obvious that a bridge of this type carried on tall and slender piers would show a tendency toward generating bending moments. For this reason, it was decided to develop the cantilever idea, cutting the bridge completely thru at the crown of each arch, thus throwing on each pier the weight of one-half of each adjoining arch and making each section entirely independent of the others. The pier also is an arch instead of being a single solid pier. Beneath each unit then is an expansion joint of about one inch for temperature variations. Over the top, of course, is a smooth asphalt highway with a sidewalk on each side.

There is along the parapet on each side, a row of electric lamps following the general design of the lamps used in the grounds to imitate the old oil lamps of Spain, giving a soft but powerful glow extremely restful to the eye. So far as is known this is the only cantilever bridge of this type which has been built. The cost was approximately $200,000, which includes the cost of the cement, rock and sand, and structural steel, which go to make up the great viaduct. The bridge was designed to carry two moving loads of fifteen tons each passing each other at any point on the bridge.

This, of course, is a part of the permanent work connected with the construction for the Exposition, as is the case with the California and Fine Arts Buildings, the Botanical Building, the great Music Pavilion, housing the largest out-door organ in the world, and the New Mexico Building. The other structures are of staff and plaster, but are uniformly made with metal lath, so that their life in the balmy climate of Southern California should be approximately twenty years. San Diego plans to use the buildings largely for educational purposes. The viaduct, of course, goes into the scheme as a portion of the park improvement, into which approximately 60 per cent. of the total cost of the Exposition has gone. Although it is stated that three years before the Exposition opened Balboa Park was a desert, today it is one of the world's finest gardens.



Waterproofing Concrete Surfaces

Mr. J. L. Lytel, project manager of the Strawberry valley project, Utah, in the *Reclamation Record*, gives an interesting experience in waterproofing concrete surfaces. The storage works and tunnel of the Strawberry valley project are located in the Wasatch mountains at an elevation of 7,500 feet. There is a wide variation in temperatures in this vicinity and the climate is very severe during the winter months.

The extreme cold, with alternate thawing and freezing of water in the pores of the exposed faces of the structures, was found to have a very destructive effect on these concrete structures, and the waterproofing of the surfaces was decided upon as a preventive against their continued disintegration.

It was decided to treat the vertical surfaces with alum and soap solutions and the horizontal surfaces with paraffin. The alum solution was made by dissolving two ounces of alum in one gallon of hot water. The soap solution was composed of three-fourths pound of castile soap dissolved in one gallon of hot water. The paraffin was boiled to drive off water, as the presence of water rendered it hard to apply. Ordinary commercial products were used.

The surface to be treated with paraffin was first thoroly dried and cleaned of loose concrete, dirt and other foreign substances. The paraffin was then heated and applied with a paint brush, and was forced into the pores by the heat of a blow torch on the surface. Only one coat of paraffin was applied, as the concrete would not absorb more.

The surface to be treated with soap and alum was prepared as above stated. The alum solution was applied at a temperature of 100 degrees F. with a moderately stiff brush and was then worked in with a stiff horse brush. While the surface was still moist from this treatment the hot soap solution was applied in the same manner as the alum solution. One treatment by each solution in the manner described above constituted a coat. If other coats were considered necessary, they were applied in like manner after the preceding coat had been allowed to stand twenty-four hours or more.

Twelve structures were given this treatment, the surface area covered being approximately 28,000 square feet. Four thousand square feet were treated with paraffin, at the rate of one pound for 11¾ square feet, and the remainder with soap and alum. It required one gallon of alum solution and a half gallon of soap solution to cover 50 square feet with two coats. Two coats of alum and soap were applied at an average total cost of 75 cents per 100 square feet, and the cost varied from 41 cents minimum to $1.28 maximum. The cost of one coat of paraffin varied from $1.70 to $3.78 per 100 square feet, and averaged $2.11. This cost covers everything except general expense. The two men who did this work received $75 and $80 per month. Brushes cost $6.06, castile soap 12½ cents per pound, alum 18 cents per pound, and crude paraffin $4.80 per hundred-weight.

MOTOR FIRE APPARATUS

NEW DEVELOPMENTS AND RECENT INSTALLATIONS ANNOUNCED SINCE THE LAST ANNUAL CONVENTION OF THE INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS

Progressive manufacturers of equipment of all classes are constantly striving to make improvements for the betterment of their products. It is a result of this constant effort on the part of manufacturers that the fire-fighting machine has been brought to a state of efficiency little dreamed of a few years ago. Since the last annual convention of the International Association of Fire Engineers many new features and devices have been developed. The significance of some of these, which mark distinct steps forward, is great, others are less important; all are interesting. In the following discussion some of the most significant improvements are described and illustrated.

AHRENS-FOX LATE MODELS.

Fig. 1 represents one of the later types of motor-driven fire apparatus as manufactured by the Ahrens-Fox Fire Engine Co., Cincinnati, Ohio. This model carries 1,250 feet of 2½-inch regulation hose, extinguisher, ladders, axes and other fire-fighting equipment. The extinguisher service of this type is augmented by uniting the chemical equipment with the main fire pumps.

Fig. 2 illustrates the Model K-2 piston pump manufactured by the Ahrens-Fox Co. This type not only displaces the horse-drawn steamer, but does away with the necessity of separate hose tender. It also carries 1,250 feet of 2½-inch regulation hose, ladders, axes and other fire-fighting equipment.

BOOSTER PUMP VS. CHEMICAL TANK.

The Ahrens-Fox Company is also featuring its Model K-11 booster hose car. Formerly, when fire apparatus was dependent upon horse draft, the chemical process served its purpose well, gas pressure then being recognized as the best way of creating the extinguishing jet.

The booster system, however, is said to possess inherent advantages which are impossible with apparatus depending upon air pressure or the result of chemical re-action. The booster idea is unique because it finds further useful work for a power plant already at hand and utilizes this at a time when it would otherwise be idle. "Soda and sulphuric acid," states

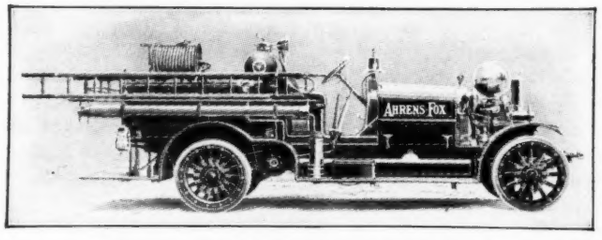


FIG. 1. AHRENS-FOX MODEL K-3 PISTON PUMP, "TRIPLE COMBINATION."

Charles H. Fox, "are not essential to the use of the extinguisher. The tank may be filled with plain water and expelled from start to finish at pressures greater than are obtainable by the carbonic acid process." The "Booster," which is a small power pump of the turbine type may be clutched at will, to engage with the crank shaft of the gasoline motor. The pump is in suction connection with the tank, and the discharge from the pump leads directly into the rotating axis of the reel, which carries the chemical hose. The response is instantaneous and immediately following the click of the starting clutch, a stream is available at the nozzle end of the chemical hose.

It is well understood that even the initial pressure realized in chemical tanks is insufficient to cope with the friction loss of the hose, together with the retarding head encountered when the nozzle is carried to elevated situations. Recharging a chemical tank during the progress of a fire is an operation which does not work out well in practice, and "by-passing" a low pressure hydrant stream into the chemical hose may, in some instances, afford no result at all. By-passing into the booster assures suitable pressure and a continuous stream, and by utilizing the auxiliary gate which is fitted to the pump, a second line of hose may be connected and an additional stream played on the fire.

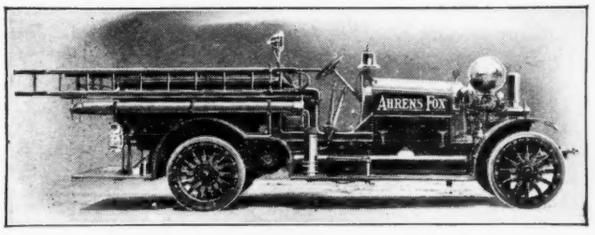


FIG. 2. AHRENS-FOX MODEL K-2 PISTON PUMP.

Driven by the four-cylinder motor, which also serves to propel the car, the power and capacity of the booster pump auxiliary, is sufficient to produce and to maintain for any desired period the full equivalent of two chemical fire engine streams. The continuity of the small jets, together with the ease and facility with which the lighter hose can be managed, are factors that make this principle effective in the hands of active men. Fires not already beyond the control of this method can be extinguished more quickly and with less property loss by water than is possible with the short-lived chemical, or, with the heavier and more cumbersome appliances.

This new Ahrens-Fox model K-11 is a booster equipped hose carrier, which supersedes the original booster car, first brought out as the model D. In its later forms, the booster pump is of the turbine or centrifugal type. The city of Cincinnati has ten booster combinations in service. Other cities operating this type are Rockford, Ill.; Sacramento, Cal.; Washington, D. C.; Chicago Heights, Ill.; Syracuse, N. Y.; Circleville, Ohio; Bloomington, Ind.; Georgetown, Ky.; Bowling Green, Ky.; Evansville, Ind. Among cities operating regulation Aherns-Fox models may be mentioned Cincinnati,; Detroit; Washington, D. C.; Wilmington, Del.; Rockford, Ill.; Sacramento, Cal.; Chicago Heights, Ill.; East Chicago, Ind.; San Antonio, Tex.; San Angelo, Tex.; San Francisco, Cal.; Salt Lake City, Utah; Evansville, Ind.; Syracuse, N. Y.; Cleveland, O.; Akron, O.; Bellefontaine, O.; Ironton, O.; Washington C. H., O.; Circleville, O.; Lambertville, N. J.; Edgewater, N. J.; Carlisle, Pa.; Niagara Falls, N. Y.; Baltimore, Md.; Martins Ferry, O.; Lynn, Mass.; Winchester, Mass.; New Bedford, Mass.; Beaumont, Tex.; Cicero, Ill., etc. Apparatus is now under construction for New York (six combination pumpers, also contracts with Philadelphia, Pa.; Chester, Pa.; San Francisco, Cal.; Danvers, Mass., etc.

WATEROUS ROTARY FIRE PUMP.

The Waterous rotary displacement pump, used on motor-driven apparatus manufactured by the Waterous Engine Works Company, St. Paul, Minn., is light, self-contained and occupies

FIG. 3. MOTOR-DRIVEN FIRE ENGINE EQUIPPED WITH "WATEROUS" IMPROVED ROTARY PUMP.

very little space. Ordinary fire service is performed by using the direct speed; that is, the engine and pump running the same speed, making a direct or straight-line drive, there being no gears of any sort in mesh. Where, however, unusually high pressures are necessary, the speed ratio between the engine and pump may be varied by means of gear shift lever, so that any pressure from zero to 300 pounds or more can be obtained at the will of the operator. This device is particularly advantageous and requires no extra gears or shifting mechanism. The transmission gears are made unusually heavy and carried in steel case, and thus made to serve two functions, either that of road work or pumping when occasion requires.

This concern is now manufacturing motor-driven pumping engines for the city of Richmond, Va.; also Jenkintown, Pa.; Schuylkill Haven, Pa., and Medina, N. Y. Recent deliveries have been made to Lansdale, Pa.; West Collinwood, N. J.; Toronto, Ont.; Monroe, Mich. Waterous engines have capacities of 400 gallons per minute upwards and motors used are 48, 70 and 100-h.p., as may be required to do the duty guaranteed. On the 400-gallon engine is placed a 4-yclinder, 48-h.p. motor; on the 500 and 600-gallon engines, 70-h.p.; on the larger engines is installed a 6-cylinder, 100-h.p. motor. Hose box will carry 1,200 feet of 2½-inch regulation fire hose.

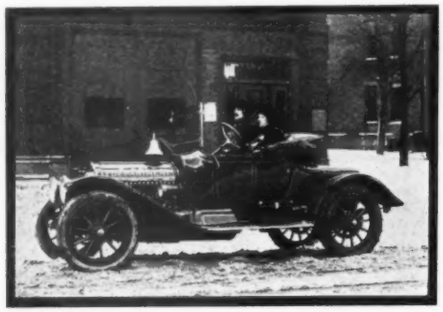


FIG. 4. WHITE CHIEF'S CAR, ROADSTER CHASSIS.

Illustration (Fig. 3) shows typical Waterous equipment—Archibald artillery type wheels; Goodyear tires; wheels are 38 inches in diameter, and the front tires are 4 inches or 5 inches, and 3-inch, 3½-inch and 4-inch dual in rear. Equipment, of course, includes electric starter, necessary complement of ladders, lanterns, torches, chemical extinguishers, suction hose, play pipes, nozzles, tools, etc.

CHASSIS FOR FIRE APPARATUS.

Figs. 4, 5, 6 and 14 illustrate typical apparatus mounted on White chassis. Fig. 20 shows a White 45-h.p. 3-ton aerial tractor. Several improvements are noted in the line of straight chemical trucks, combination hose and chemicals, service ladder, 1½ and 3-ton tractors and underslung chassis for steam boiler and engine. Specifications also cover chemical engines with a 30-h.p. motor, combination hose and chemicals with 30-h.p., combination hose and chemicals with 45-h.p., combination hose and chemicals with 60-h.p., service ladder trucks with 60-h.p. motor, light tractor for hauling a service ladder truck with 60-h.p. motor, heavy tractor for hauling an aerial ladder truck with 45-h.p. motor, underslung 3-ton chassis with 45-h.p. motor, carrying a second-size boiler and engine, and also a 30-h.p. chief's car and a 60-h.p. insurance patrol.

"The chief's car," states Jas. B. Ludlow, of the public utilities department, "is usually nothing but a roadster chassis, either a 30, 45 or 60-h.p., some of which have no fire equipment at all, others merely have the hand extinguishers, while others have a chemical tank and equipment. The various insurance patrols or salvage corps have their own ideas as to just what equipment they require, and consequently there is

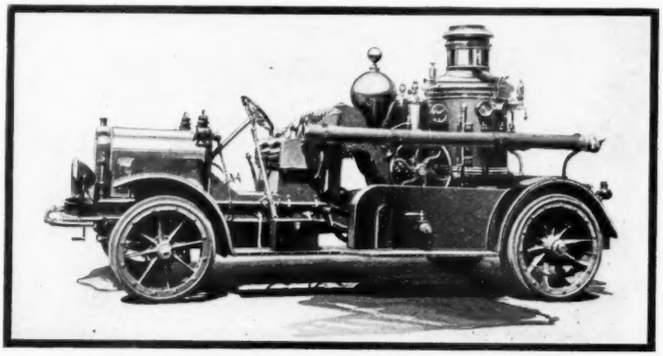


FIG. 5. WHITE 3-TON UNDERSLUNG TRACTOR.

nothing that is standard, altho it is usually merely a 1½-ton chassis, with either the 30, 45 or 60-h.p. motor and whatever arrangement of body and equipment they may desire."

MAKE BUT ONE TYPE.

The Autocar Company, Ardmore, Pa., make but one type of chassis, their regulation type XX1-F, rated at 1½ to 2 tons capacity, as illustrated by Fig. 7, and used in the following departments: Milltown Fire Co., Milltown, N. J.; Paterson Fire Department, Paterson, N. J.; Union Fire Association, Cynwyd, Pa.; Merion Fire Co., Ardmore, Pa.; Royersford Fire Co., Royersford, Pa.; Stroudsburg Fire Co., Stroudsburg, Pa.; West Chester Fire Co., West Chester, Pa.; Alert Volunteer Fire Co., Raspeburg, Md.; the Geo. Clay Fire Co., Conshohocken, Pa.; Oakmont Fire Co., Oakmont, Pa.; Providence Fire Department, Providence, R. I.; Darby Fire Patrol, Darby, Pa.; Young American Fire Co., Burlington, N. J.

KISSEL-BERDON LIGHTING SYSTEM.

In KisselKar combination hose and chemical squipment, Fig. 8, is included the Berdon lighting system, made by the Esterline Company. This consists of a positively-driven, direct-current, permanent-magneto generator, a storage battery and an automatic, self-setting, low-voltage release, overload,

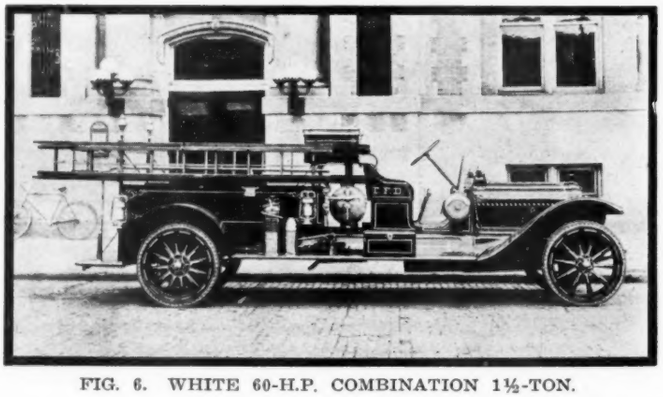


FIG. 6. WHITE 60-H.P. COMBINATION 1½-TON.

reverse-current controller. The generator is run by a silent chain from gear coupled to the pump shaft. The purpose of generator is to supply current for the lights and to charge the battery. The battery stores the surplus energy and supplies current for the lights and ignition when car is running at very slow speed or at rest. The controller automatically takes care of the charging of the battery without attention. Headlights are large solar lamps, and dash and taillights are combination oil and electric. All lights are controlled by one four-point switch of following positions: First position, all lights off; second position, side and taillights on; third position, head and taillights on; fourth position, all lights on.

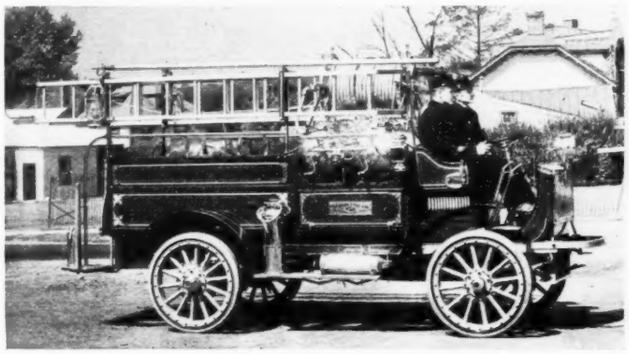


FIG. 7. AUTOCAR COMBINATION CHEMICAL AND HOSE.

The electric starter is of Kissel design and is operated from same storage battery as lighting system. By pressing a foot plunger on dash, a gear of the electric motor is thrown in mesh with gear teeth in flywheel. At the same time connections are made with storage battery and motor is turned over at the rate of seventy-five revolutions per minute. As soon as engine is running on its own power, by releasing foot pressure the electric motor is disengaged from flywheel and remains idle while car is running.

AMERICAN-LA FRANCE TRACTORS.

American-La France gasoline tractors, types 17 and 31, as illustrated (Fig. 9 and Fig. 10), are so designed that they can be placed under horse-drawn apparatus without taking apparatus out of commission. Type 17 may be described as follows:

Motor: 6-cylinder, 5½-inch bore, 6-inch stroke. Transmission: 3 speeds forward, 1 reverse. Drive: Double side chain from jackshaft sprocket to rear-wheel sprockets. Brake: Internal expanding brake in drums attached to rear wheels. Frame: Pressed chrome nickel steel. Springs: Semi-elliptic front and rear. Axles: Front, solid drop forged, 1 section; rear, drop-forged square section; Timken roller bearings. Wheels: Artillery type, specially selected wood. Tires: Solid, front single, rear dual. Wheel base: 156¾ inches. Gasoline capacity: 15 gallons. Lighting system: Two 10-inch electric reflector lamps, one 10-inch electric searchlight. Hand-operated siren horn, tool box, battery box, all necessary operating and tire tools.

FIG. 8. KISSEL KAR 60-H.P. COMBINATION HOSE AND CHEMICAL.

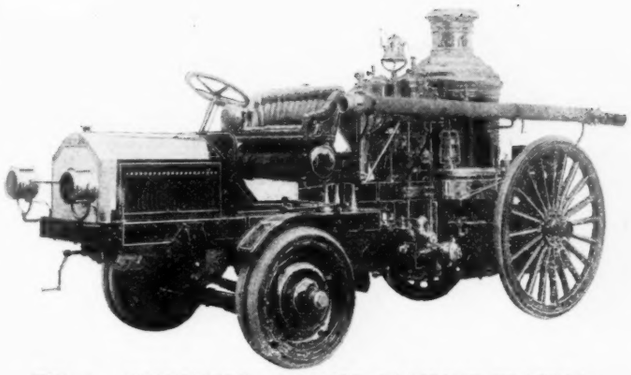


FIG. 9. AMERICAN-LA FRANCE GASOLINE TRACTOR.

Type 31 American-La France gasoline motor tractor has 2-wheel front drive, 4 cylinders, 4-cycle chain drive.

JEFFREY QUAD FIRE TRUCK.

Fig. 11 illustrates the Jeffrey Quad fire truck recently furnished the city of Collinsville, Ill., and Lebanon, N. H. This type of chassis is equipped with power in all four wheels. It is provided with the M. & S. automatic locking differentials, one in the front driving shaft and the other in the rear driving shaft. The action of these differentials is such that none of the road wheels of the vehicle can lag in speed behind the motor. The two outermost wheels can overrun the others in turning a corner, but as soon as any wheel tends to lag behind the motor, the differential automatically locks, and the driving shaft is virtually solid from wheel to wheel. If one wheel does not get traction and the other does, the latter immediately takes all the power that previously the two wheels would have shared, and as long as it can get traction it will pull the vehicle out of the hole. As long as any one or more of the driving wheels can get traction when the others cannot, and the motor has power enough to move the truck, the Quad will continue to travel.

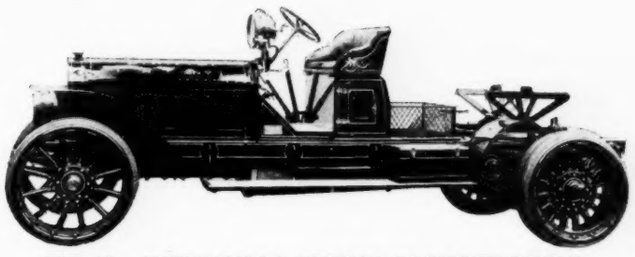


FIG. 10. AMERICAN-LA FRANCE GASOLINE MOTOR TRACTOR.

A silent chain transmits the power to the shaft, which runs right thru the transmission case. At each end of this shaft is a universal joint, which connects with a drive shaft extending to the bevel pinion in the differential housing. One of these longitudinal drive shafts connects with the differential on the front axle and the other with the differential on the rear axle, another universal joint being introduced near the differential in each case. The bevel pinion drives a bevel gear at right angles to it, as in the ordinary type of automobile rear-axle or jackshaft construction.

GAS-ELECTRIC AND BATTERY PROPELLED.

Fig. 12 illustrates a popular type of front-drive gas-electric propelled tractor, as made by the Couple-Gear Freight-Wheel Company and used in connection with standard type of steam-

FIG. 11. JEFFREY QUAD FIRE TRUCK.

er. This machine is driven from the forward wheels only, and has a complete weight of 20,000 pounds and gives a speed up to 20 miles per hour. This concern also makes gas-electric as well as battery-propelled aerial ladder outfits, which, when completely manned, weigh approximately 10 tons each, with a speed ranging up to 25 miles per hour. The ladders are lifted by means of air pressure and their movement controlled by means of liquid cylinders.

The couple-gear 6-wheel water tower, gas-electric propelled, has a speed ranging up to 25 miles per hour, and weighs approximately 9 tons. The power equipment consists of a 5¾ by 6-inch 4-cylinder, 4-cycle engine, direct attached to generator.

The couple-gear battery-propelled tractor, as used in connection with steamer, has a battery of 80 cells, 15-plate capacity. The weight is approximately 20,000 pounds, with speeds ranging up to 20 miles. Six of these heavy pieces are in use in Grand Rapids, and a like number in Springfield, Mass.; seven in New York; three in Philadelphia; three in Trenton, N. J.; two in Akron, Ohio; and one each in such cities as New Haven, Conn., Newark, N. J., Wilmington, Del., Washington, D. C., North Yakima, Wash., Calgary, Alberta, Vancouver, B. C., Medicine Hat, Alberta, and Butte, Mont.

THE DAYTON TRI-CAR CHEMICAL.

The Dayton tri-car chemical (Fig. 13), as made by the Davis Sewing Machine Co., Dayton, O., carries the following equipment: 35-gallon special Holloway type chemical tank, 200 feet ¾-inch best quality F. D. chemical hose, 2 F. D. 3-gallon hand extinguishers, 1 extra acid bottle holder, 1 extra soda charge in canister, 1 F. D. pick-head axe, 1 F. D. crowbar, 1 12-foot extension ladder, 2 F. D. regulation lanterns, 1 tool box, 1 F. D. pike pole ceiling hook, 1 locomotive bell.

Among the construction features of the Dayton tri-car should be mentioned the following: Special heavy drop-forged steel frame, sheet-steel tank foundation, specially strong steel-tube construction; twin-cylinder special engine, two speeds, can be stopped and started on low gear on side of steepest hill, and will climb any hill, 14-h.p. and 45 miles per hour on high gear; Dayton airless tires, 1-wheel drive, rear of machine can be easily lifted off ground, heavy wood, steel-lined rims and extra strong steel spokes, all bright parts of finest brass or nickel, lead-lined regulation F. D. steel acid-proof tanks, standard auto tread, 56 inches, 76-inch wheel base, tires 28 by 3-inch clincher, Splitdorf magneto-generator unit, furnishing current for both lighting and ignition, electric lights, locomotive bell, easy riding seats, special heavy brakes, and regulation fire department equipment.

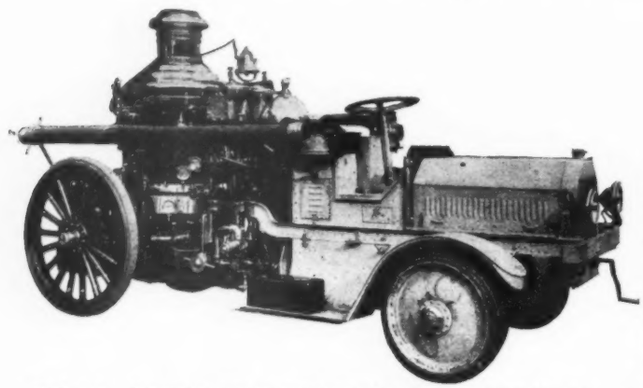


FIG. 13. COUPLE-GEAR FRONT-DRIVE GAS-ELECTRIC TRACTOR.

NORTHERN FIRE APPARATUS EQUIPMENT.

The standard equipment furnished by the Northern Fire Apparatus Co., Minneapolis, is illustrated by Fig. 15. The 40-h.p. combination chemical and hose cars made by this concern are in service in such cities as Fremont, Neb., Quanah, Tex., Gainesville, Tex., Tullahoma, Tenn., Oklahoma City, Okla.

WILLYS-KNIGHT CARS.

Fig. 16 illustrates Willys-Knight cars as used in the Toledo and Tiffin (Ohio) fire departments. The following excerpts from the specifications may be of interest:

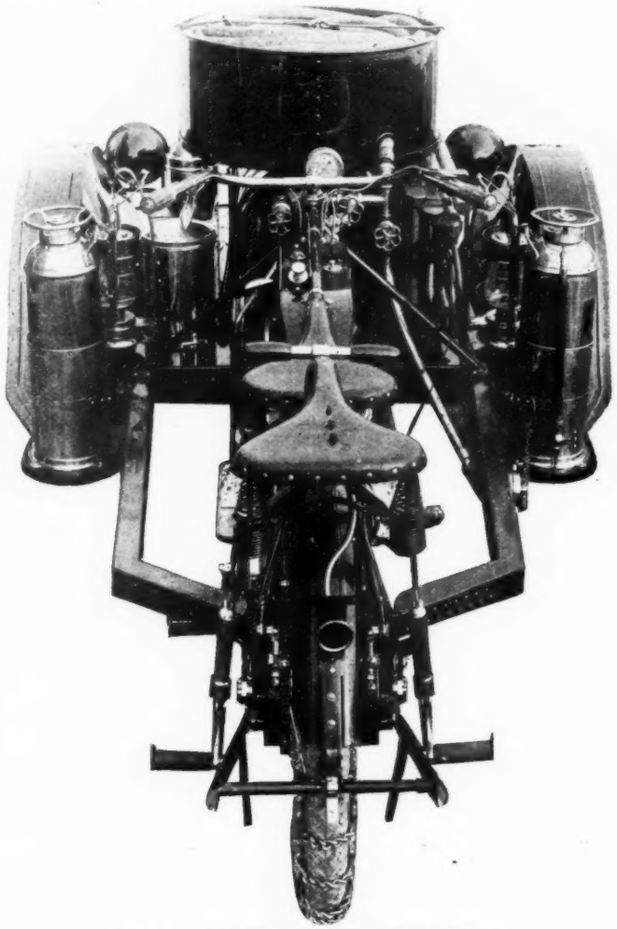


FIG. 13. DAYTON TRI-CAR CHEMICAL.

Motor: Four cylinders, cast en bloc, 4¼-inch bore, 4½-inch stroke; crank case, oil base and water jacket cover, aluminum; 40-h.p. Ignition: High-tension magneto, no dry batteries required, independent of starting and lighting, permits simple wiring. Gasoline supply: Vacuum tank system, positive and uniform feed, carbureter improved type with hot-air attachment, simple adjustment. Wheel base: 114 inches. Tread: 56 inches. Transmission: Selective sliding gear type, located at rear axle as a unit with differential; three speeds forward, and reverse; double-heat-treated nickel-steel gears of stub-tooth type; annular ball bearings. Brakes: Large and powerful,

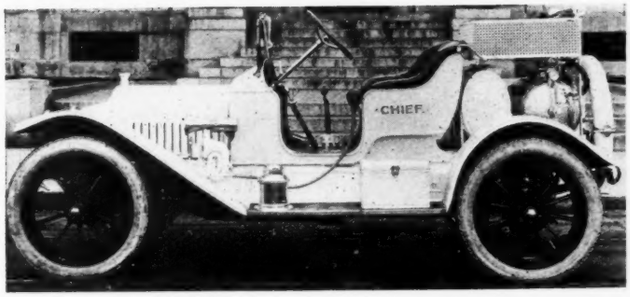


FIG. 14. WHITE FIRE CHIEF'S CAR-STANDARD ROADSTER CHASSIS, GREEN BAY, WIS.

ample for much heavier car; service, contracting, 14⅜ by 2¼ inches; emergency, expanding, 14 by 2¼ inches; operate on rear wheel drums; quick adjustable. Wheels: Artillery type, hickory spokes, 12 spokes and 12 bolts in each wheel.

BOYD MOTOR AERIAL TRUCK.

An improved type of ladder, hose and chemical truck, as made by James Boyd & Bro., Philadelphia, is illustrated by Fig. 17. This concern is also featuring its motor-driven aerial truck and worm-drive tractor. The aerial truck has a power

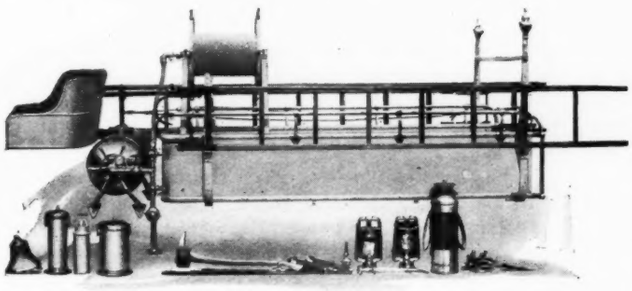


FIG. 15. STANDARD EQUIPMENT NORTHERN FIRE APPARATUS COMPANY.

attachment which will both raise and lower the ladder, as well as revolve the turntable. A fireman may be placed on end of main ladder and raised to full height in about eight seconds. The motor is placed in center of frame, thus giving equal distribution of weight. This type of aerial truck is in service in the cities of Reading, Pa., Lorain, O., Moline, Ill., Wheeling, W. Va., Philadelphia, Pa., and Camden, N. J.

The Boyd worm-drive tractor has but five working parts, inclosed in oil and air-tight housings.

POPULAR SEAGRAVE SPECIALTIES.

A motor city-service hook and ladder truck made by the Seagrave Co., Columbus, O., is illustrated by Fig. 18. This truck is the same in construction as the Seagrave rear-drive-and-steer truck, except the rear wheels cannot be steered. It is particularly desirable for city and town use and will carry extension ladders up to 60 feet in length. Can be furnished with 4-cylinder 50-h.p. or 6-cylinder 80-h.p. motor. Transmission is 3 speeds forward and 1 reverse. Dual ignition system. Solid or cushion tires. Vanadium steel springs. Bosch magneto.

The Seagrave rear-drive-and-steer hook and ladder truck is furnished with either 4-cylinder 50-h.p. or 6-clinder 80-h.p. motor. It is a straight gasoline-propelled truck, with no electrical complications. The drive is thru the rear wheels and these wheels can also be steered, which makes the truck particularly adapted to carrying long ladders and getting around in narrow streets or out of engine houses where the space is limited. The rear-drive construction is the same as is used on the 4-wheel-drive-and-steer aerial trucks.

The Seagrave straight gasoline-propelled 4-wheel-drive-and-steer aerial hook and ladder truck is made in three sizes, 65-foot, 75-foot and 85-foot. Aerial ladder is automatically raised in 6 seconds. One man can raise, place in position, operate turntable or lower ladder. The motive power used is a 6-cylinder 80-h.p. motor. Transmission has four speeds forward and one reverse, from which the power is transmitted to all wheels thru ball universal, thus permitting the driving and steering of all wheels at the same time.

THE HARLEY-DAVIDSON MODEL.

The use of motorcycles in fire departments is illustrated in Fig. 19. Many of this type are equipped with hand chemical apparatus. This type of motorcycle is equipped with starters and all necessary accessories. The application on the 3-speed model 11-F is thru the transmission case, but its principle is exactly the same as on the other Harley-Davidson models. A forward down stroke on either pedal starts the motor. A back kick (which sometimes occurs when an excited fireman advances the magneto too far and opens the throttle too wide) automatically disengages the starter, doing away with possible injury to the starting mechanism. This is an important feature.

THE THOMAS AUTOMATIC SYSTEM.

The Thomas automatic chemical pumping fire engine (Fig. 21) incorporates the use of bicarbonate of soda as a fire extinguishing agency. Plain baking soda and plain water only are used. This machine injects a given quantity of plain bicarbonate of soda automatically into each cubic inch of water as it is pumped into the fire. The feed is absolutely positive and mathematically correct. When the chemicalized water is discharged into the fire, more or less of the solution is heated. The amount of heated water depends upon the intensity of the fire. When the solution is heated to 110 degrees and higher the carbonic gas with which the soda is charged is released and in just such proportion as the quantity of soda water is

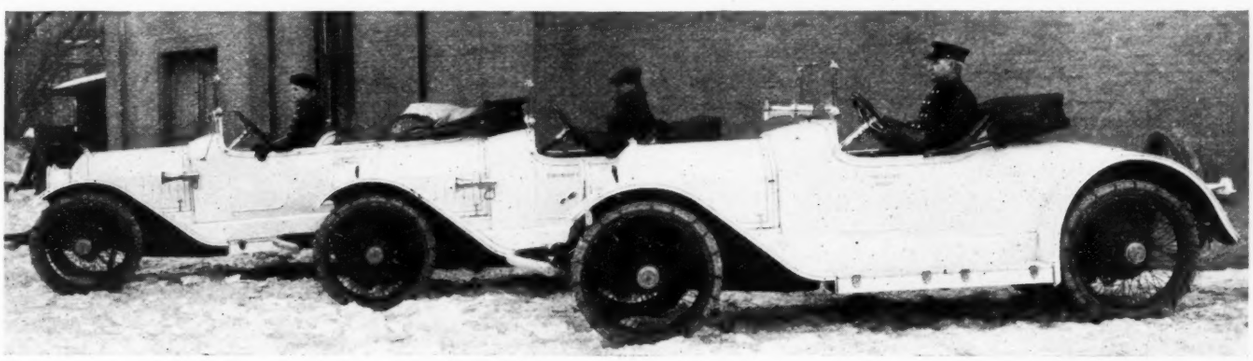


FIG. 16. WILLYS-KNIGHT CARS IN SERVICE OF TOLEDO (OHIO) FIRE AND POLICE DEPARTMENTS.

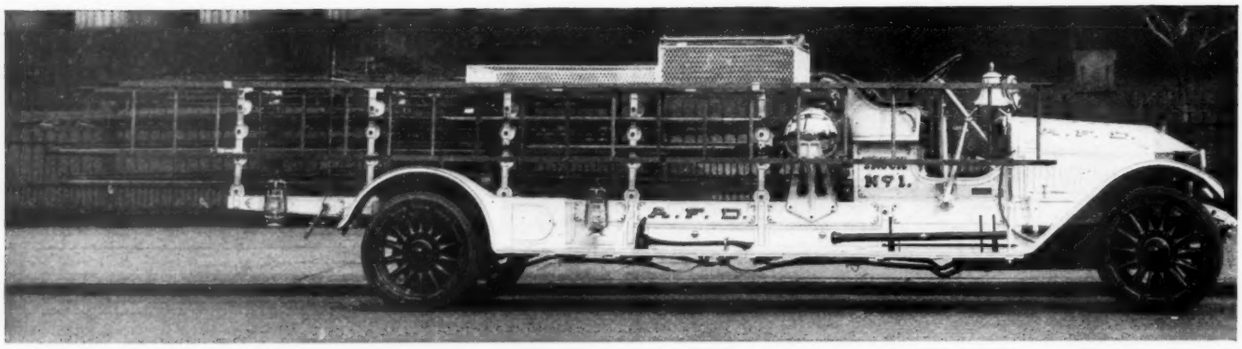


FIG. 17. BOYD COMBINATION LADDER, HOSE AND CHEMICAL TRUCK.

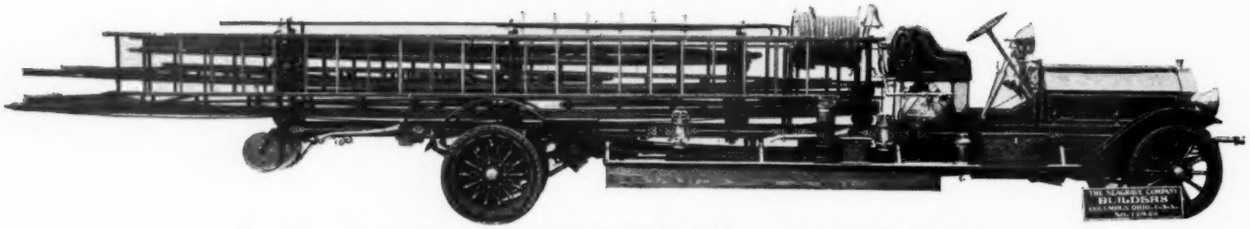


FIG. 18. SEAGRAVE MOTOR CITY SERVICE HOOK AND LADDER TRUCK.

heated. The lowest degree of combustion or ignition is 300. At 212 degrees (boiling point of water) soda water is wild with foam. Therefore, soda water releases enormous amounts of carbonic gas (neutral gas) at the boiling point and above. The hotter the fire the greater the expansion of carbonic (neutral gas, controlling and extinguishing large volumes of fire instantly.

The Thomas automatic fire engine is composed of a main water pump, a chemical pump and a chemical conveyor and mixing chamber, all geared together in their respective relations to each other. Rotary-type deep-suction main pump is fitted with solid bronze lifting cams, carefully machined and ground, fitted with brass valves installed upon chrome nickel steel shafts set in Hess-Bright ball bearings. Pump body is gray cast iron, the double inlets fitted with brass hard suction couplings with caps. Single discharge is fitted for two or more 2½-inch brass hose connections with caps, each connection controlled by individual quick-opening valves, an automatic relief valve connecting inlet and outlet of the pump.

The chemical (triplex) pump is geared to the main pump. Brass plungers, brass valves, all bearings fitted with grease cups.

The chemical conveyor of the Thomas automatic fire engine consists of a graduated worm feed, fitted with chrome nickel steel shaft, with Morse chain drive from main pump, having the same speed of the main pump, maintaining exact proportions of soda and water, notwithstanding the speed of the main pump. The chemical conveyor is installed upon a chemical mixing chamber, which is supplied with a constant stream of water under pump head pressure, which dissolves the soda as it drops into the mixing chamber, which is in suction relation with the chemical pump, thus taking the resultant solution from the mixing chamber and forcing it into the main water column immediately ahead of the main pump. From this point to the fire the entire stream is chemicalized in absolutely correct proportions and the highest efficiency is attained thereby. A chemical receiving hopper is installed above the graduated worm-feed conveyor, which is fed by hand, and from this point the mechanism automatically chemicalizes the water. The feed of soda may be discontinued at the will of the operator, and if the supply becomes exhausted, the pumps continue to discharge plain water without any adjustment of the mechanism. The hopper, conveyor, mixing chamber and all valves and suction pipes are of finished brass.

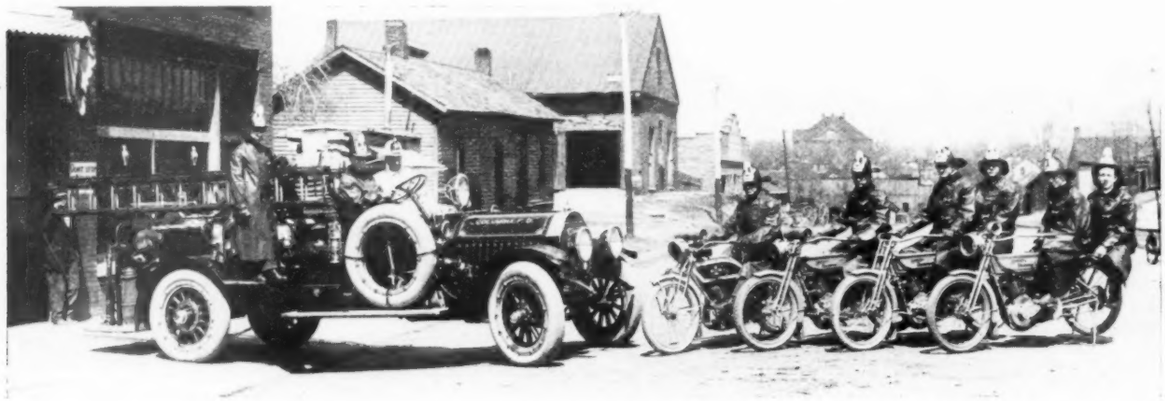


FIG. 19. HARLEY DAVIDSON MOTORCYCLES, COLUMBIA (MO.) FIRE DEPARTMENT.

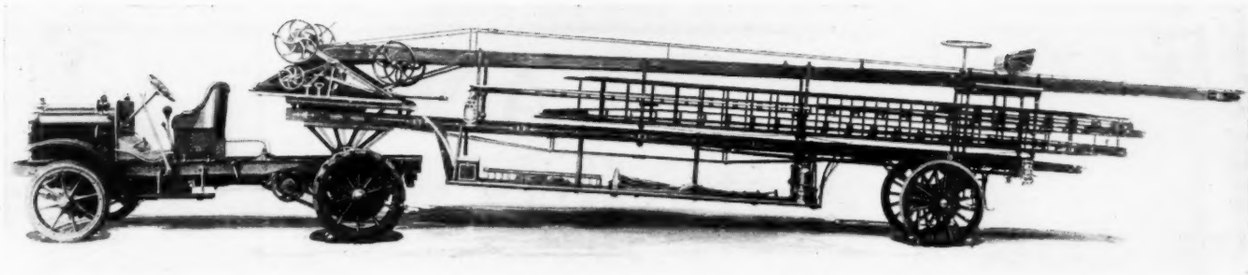


FIG. 20. WHITE 45-H.P. 3-TON AERIAL TRACTOR.

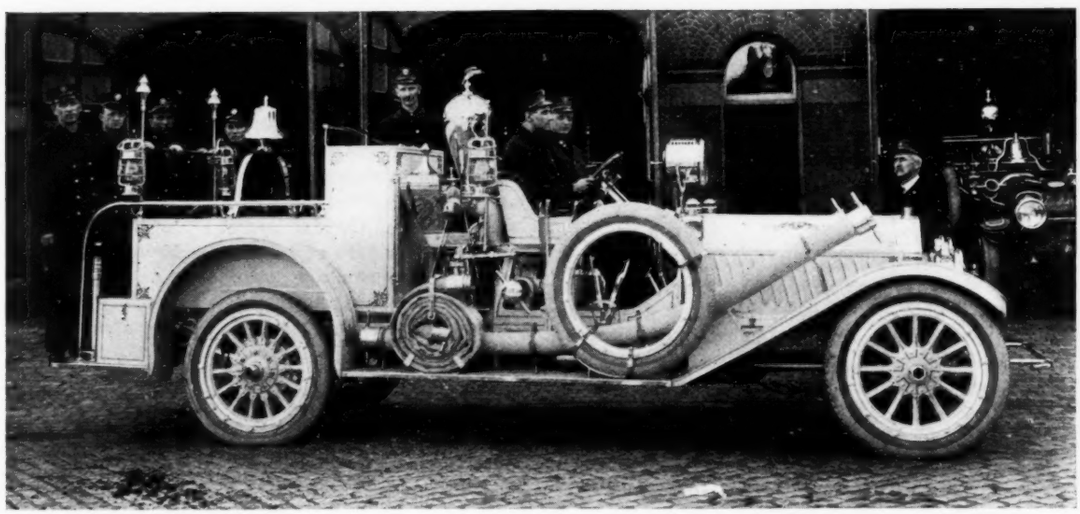


FIG. 21. THOMAS AUTOMATIC CHEMICAL PUMPING FIRE ENGINE.

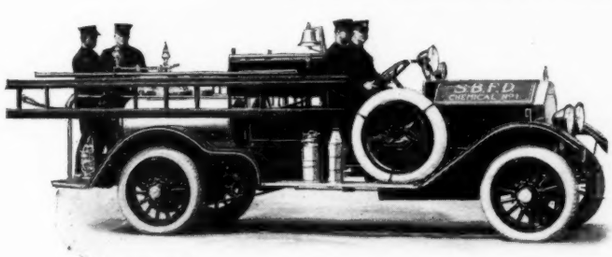


FIG. 22. SOUTH BEND 80-H.P. CHEMICAL ENGINE.

The Thomas (type Lewis B45) 4-cylinder has a chemical pumping capacity of 360 gallons per minute. Dry soda capacity is 1,000 pounds, which makes 8,000 gallons soda solution without recharging. There are two hose lines. Hose capacity is 1,000 feet of 2½-inch.

The Thomas (type W.P.60) 6-cylinder has a chemical pumping capacity of 600 gallons per minute. Dry soda capacity is 1,500 pounds, which makes 12,000 gallons soda solution without recharging. There are three hose lines. Hose capacity is 1,200 to 1,500 feet of 2½-inch.

SOUTH BEND DOUBLE-DUTY APPARATUS.

Figs. 22 and 23 illustrate side and rear views of the "Double-Duty" 80-h.p. chemical engine as made by the South Bend Motor Car Works. Apparatus of this type, which is in service in such cities as Logansport, Gary, Manitowoc, Independence, etc., may be tersely described as follows:

Speed: 10 to 60 miles per hour; wheel base: 152 inches; wheels: artillery type, made of wood; ignition: Bosch; starting: Bosch 2-unit system, starting from flywheel; gasoline capacity: 25 gallons; lighting system: 2 10-inch electric headlights, 1 10-inch electric searchlight, 1 electric taillight; chemical tanks: 2 of 60 or 70 gallons capacity; chemical hose: 2 lines of 200 feet each; acid receptacles: 4; acid receptacle holders: 2; extinguishers: 2 3-gallon Babcock fire department standard; alarm devices: 1 locomotive bell and 1 hand-operated Siren horn; ladders: 1 20-foot extension ladder, 1 12-foot roof ladder with folding hooks; lanterns: 4 fire department standard; axe: 1; crowbar: 1 of steel, securely held by snaps; pike pole: 1; tool box: 1; tools: 1 complete set, including all necessary tire tools; battery box: 1; carrying capacity: 6 men.

The South Bend Motor Car Works have recently started building a 6-cylinder 140-h.p. triple combination, equipped with a Rumsey pump delivering 800 gallons of water per minute.

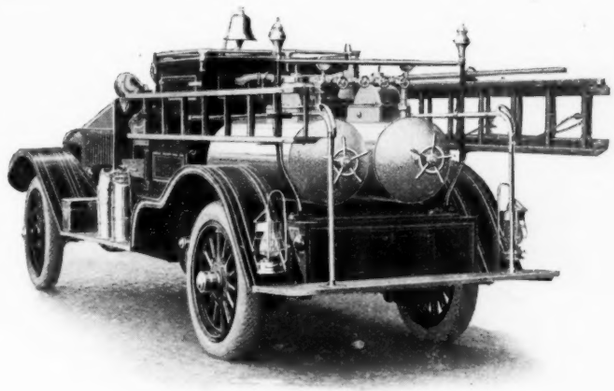


FIG. 23. REAR VIEW SOUTH BEND CHEMICAL ENGINE.

ROADS AND PAVEMENTS

Width of Bridges and Highways

In connection with the width of bridges, Prof. Charles M. Spofford of the Massachusetts Institute of Technology, Boston, Mass., in a paper presented before the Western Society of Engineers, calls attention to the fact that the capacity of a bridge in vehicles per hour is considerably greater than that of the ordinary street, due to the freedom from interruption of traffic on intersecting streets, and by vehicles stopping at the curb to discharge and receive freight or passengers. For example, the effective width of the roadway on Boylston street, Boston, by actual measurements is not more than 36 feet, the vehicle standing at the curb requiring at least 14 feet.

Mr. Spofford cites statistics regarding other well-known streets as follows:

New York—Fifth avenue, south of 59th street. Width of roadway, 55 feet between curbs; no street railway; six lines of traffic possible in addition to vehicles standing at curb.

New York—Broadway at Rector street. Width between curbs, 35 feet, with double track street railway; four lines of traffic possible, but with no room for vehicles to pass between car and truck standing at the curb.

London—Piccadilly. Width of roadway, 37 feet; no street car traffic; traffic between 8 a. m. and 8 p. m., 15,284 vehicles.

Boston—Washington street, south of Summer street. Width between curbs, 32.5 feet, with double track railway; four lines of traffic in all, with just room for a vehicle to pass between a car and the curb.

Boston—Boylston street, between Berkeley and Arlington street. Width between curbs, 50.2 feet, with double track railway; room for six lines of traffic in all or for four lines of traffic with ample room for a vehicle to pass between a car and another vehicle standing at the curb.

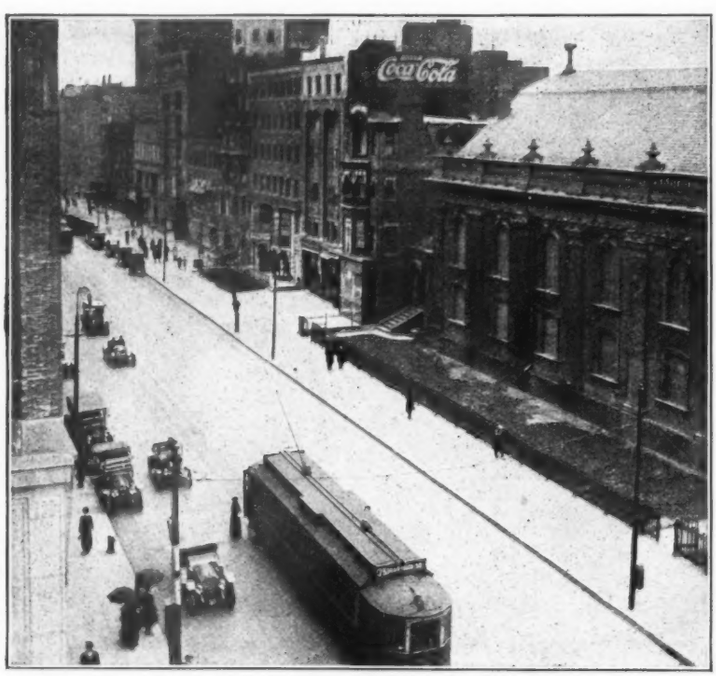
Berlin—Leipzigerstrasse. Width of roadway, 52.5 feet.

Berlin—Friedrichstrasse. Width of roadway, 26.25 feet (narrowest part).

Paris—Avenue de l'Opera. Width of roadway, 52.5 feet.

Vienna—Praterstrasse. Width of roadway, 36 feet.

Paris—Rue de Rivoli. Width of roadway, 39 feet (narrowest part).



BOYLSTON STREET, BOSTON, EFFECTIVE WIDTH THIRTY-SIX FEET.

Vertical Fiber Brick Paving

By James I. Tucker, Director of the School of Civil Engineering, University of Oklahoma, Norman, Okla., before Iowa Engineering Society.

Vertical fiber in brick is a phenomenon that in the minds of many has been only an *idea*. Some persons inspired by reasons best known to themselves have claimed that the idea is futile, preposterous and absurd, and only a catch phrase designed to arrest the ear and attention of the uninitiated in order that old facts might be presented to taxpayers under a guise seemingly new, with a considerable commercial exploitation accruing to the benefit of the manufacturer of the article. It will be one purpose of this paper, therefore, to show that there is a rational basis for the phrase "vertical fiber brick" and to further indicate the importance of that and other collateral ideas involved.

The start is best made by reference to a familiar geologic fact, namely the dynamic history of the stone known as micashist, or any other stone of a shistose structure. With good reason we believe that this stone owes its peculiar laminated structure to great pressure and a sliding movement taking place in the presence of great heat and moisture. The results of these changes have been put to many of the materials composing the matrix of the stone into a pasty and plastic condition, while the harder non-plastic constituents were perforce arranged by the movement into positions of least resistance. Their longest axes were thus made parallel to the direction of motion, or in more homely language, every little flake of mica turned edgewise to the movement and not crosswise, or if it did, it was crushed to powder.

It is evident to everyone that the arrangement of these thin flat particles or layers in parallel positions is an element of weakness to a force applied lengthwise of them, but they may be an element of strength to loads applied crosswise to their flat sides. The bedding planes of shale rock furnish another example of the same phenomena.

Let us now see what happens in a brick machine. The shale or other material is first thoroly pulverized in a grinding mill, then wet or tempered to the consistency that experience has shown to be best. When in this thoroly pasty state with all its particles thoroly lubricated by the water present, the clay is passed to the auger machine or die, and molded into the clay column from which the brick are cut. The auger machine works on the familiar principle of the meat chopper, only that its screw fits tighter in its clylindrical casing, is fed from the rear and is actuated by an enormous amount of energy, since frequently as much as 75 hp. are spent at this point alone.

The front end of the machine is a die, consisting of a rectangular opening at the end of a funnel, to use another homely simile. If the brick are to be end-cut then the opening equals the smallest cross section of a brick, if side-cut then it is the larger cross section.

If now we assume that all the particles of shale have not been ground to exactly the same fineness in the grinder, as certainly we may, it is clear that under the tremendous energy of say 40,000 foot-pounds per second exerted by the auger, if the particles are free to move over one another, as they certainly are, by reason of the water present, then the larger particles will necessarily be arranged with their long dimensions to lie parallel to the application of the force, i. e., they are lined up straight for the opening of the die—since to force them thru that opening is the sole function which the screw so effectively performs. If these hypotheses are true we may certainly claim that there is a real *fiber* in the brick. But this is not all.

We saw that in the case of the schists the surrounding materials had a sliding movement which was largely instrumental in arranging the particles. This happens in the auger machine also. To justify this statement we have only to admit that the friction of the plastic material upon the interior walls of the auger machine is at least different from the interior friction of the material itself. From this it must follow that the material in contact with the walls must move at a different rate from that being propelled by the screw.

In further proof of the same point we need only observe that the walls of the chamber taper down to the die-opening and we are at once forced to the conclusion that the center of the material in the chamber will be propelled forward and outward at a greater rate than the outer parts of the same material.

While these various phenomena are so far demonstrable by reasoning alone, there have been practical demonstrations that this reasoning is correct. Mr. Claude Fuller of the Buffalo Brick Company of Buffalo, Kan., made some extremely valuable and interesting experiments with the auger machine at that plant some time prior to December, 1912, when the results were observed by the speaker. Taking off the conical portion of the auger machine which carried the die opening, while the chamber was filled with clay, he brought the exposed part to a plane surface and then treated it to a liberal coat of paint, after which he replaced the conical section. Upon starting the machine he found that this painted plane was bulged forward by the screw, as would be expected, and that the central portion of the plane arrived at the front end of the clay column which had passed thru the die at a distance of about four feet in advance of those parts of the painted plane lying near the walls of the clay chamber. As would also be expected he found that the diameter of the painted section steadily increased with the advancement of the material thru the die, from a mere feather-edge at the center of the column to the place where is appeared as a smear on its surface, indicating clearly enough that then all of the material immediately in front of the painted surface had been propelled thru the die, but that the central portion traveled perhaps four feet while the peripheral portions traveled eight to ten inches. He further found that a change in the pitch of the auger produced different results, and introduced a number of varying features in his experiments. All of the foregoing shows clearly that with the different speed between the different portions of the material adjacent to the die there must, therefore, be the sliding motion used as a hypothesis at the outset.

Now since the clay column in the case we are considering furnished side-cut brick it follows that if they are laid on their flat or larger side as the Western Association intends them to be used, this fiber whose presence we have just argued must stand on end or vertical, hence the name "vertical fiber brick."

Some objectors will doubtless arise at this point and claim that the whole discussion of fiber in brick is incompatible with the theory of incipient fusion commonly known as vitrification, which every shale paving brick manufacturer puts into practice; that is to say, if the particles of clay are in fact substantially melted or fused, then they cease to have any visible fibrous arrangement. We may grant that if the materials are thoroly ground to a uniform size and then brought to complete fusion the argument for fiber is gone. We may also admit that it is nearly gone if there is incipient fusion. We do not need to grant, however, that the particles have at any stage short of complete fusion been totally *rearranged*, and even tho they have been melted and fused together they may still lie in the same relation, one to the other, as was seen to be the result of passing thru the auger machine. This means, therefore, that the contention for a fiber is justifiable even tho such fibrous arrangement is invisible to the eye. Its effects, if there are any, can be at least rationally anticipated and such cognizance taken of this reasoning as will permit a constructional use of the material which will permit this factor to become an advantage instead of a detriment. This means laying the brick flat.

The foregoing discussion indicates that if there are any laminations, planes, fibers or surfaces of weakness in such paving brick they will be parallel to the direction of motion thru the auger machine, and thus will pass thru the brick by its smallest dimension, i. e., up and down if the brick is laid flat. As an argument for the practical advantage of this, the analogy is often claimed that the brick so placed is like a wood paving block where the end of the grain is the only proper surface to take the abrasion of traffic. To let the traffic pass parallel to the grain is obviously bad—then why is not the argument equally valid for the fiber in brick—if we grant the possibility of such a fiber. If the wood block splits off when its sides are exposed to wear will not a brick if it has laminations or fibers then do the same thing, under similar conditions? Whether we admit the argument for fiber or not can we not agree that we are at least giving the brick a fairer show to lay it flat with its fiber on end, if it has any, than to lay it on its side with its fiber flat-wise to traffic—still if it has any. Aren't we, therefore, at least giving it the benefit of the doubt every time we lay a side-cut brick on its flat side? And will any engineer hold that the street service imposed upon any pavement is not sufficiently severe so that the best paving materials known should *have* the benefit of all the doubt? If, therefore, these various contentions are granted, then the logic of the departure, over two years ago, of the Western Paving Brick Manufacturers' Association from

the then standard methods of laying paving brick becomes clear.

But the laying of the brick on their sides was not the only radical departure in the Western Association's practice. Another vital argument made by them was that repressing the brick did not, as had been popularly supposed, increase their strength but really weakened them. In fact, brick manufacturers have been heard to say that the idea of repressing was to secure round corners and smooth surfaces, which would better withstand the rattler test by reason of minimizing chipping on the corners. There can be no doubt that from this standpoint repressing was a success. Since however the mold on repressing machines commonly change the dimensions of the brick, and not necessarily in their original ratio it follows that whatever structure of a fibrous nature had been built up by the auger machine was certainly upset and distorted in the repressing machine. In a word the repressed brick was not so strong as the non-repressed brick. Certainly as a result of several hundred rattler tests on both kinds of brick the speaker has never seen any evidence that non-repressed brick was weaker than the repressed article.

Again, the unjustifiable repressing, designed to help a poorer article thru the rattler test, in the end handicapped the brick as a paving material, since the round corners imposed by it seriously complicate the joint filler problem. With the grout filler the feather edge caused by these round corners could hardly fail to soon wear off under traffic. Next the main part of the joint would be bound to suffer, and shortly there would be a pronounced depression at each joint inevitably causing a rattle and clatter from every sort of wheeled vehicle save those on rubber tires. Noisiness, one of the main objections to brick paving, thus arose.

The non-repressed brick however greatly lessens this difficulty because its full square corners lessen the width of the joint to at most one-third of the grout filler joint area for round-corner brick. Hence any joint filler has a better chance to give a good account of itself with square in place of round corners.

Los Angeles Municipal Asphalt Plant

The new municipal asphalt plant at Los Angeles has been in operation since April 14. P. P. O'Brien, who is in charge of street work and has the plant under his immediate supervision, is enthusiastic over its initial success. He says:

"Between April 14 and June 30, or a period of a trifle over ten weeks, the saving effected by the city-owned asphalt plant amounted to about $6,000. To be exact, the city turned out 58,330 cubic yards of asphalt at a total cost of $8,354.62, or 14 and 32-100 cents per yard. Formerly this asphalt cost 25 cents a yard, when purchased of contractors."

He does not say whether allowances have been made for interest and depreciation on the plant, or for repairs; which probably have cost very little or nothing, since the plant is new. If these items must be added to the cost he reports, in order to make it comparable with the contract price, the difference between the two will not be so pronounced, tho it will still be considerable, if one may judge from reports of other municipal plants.

Engineers Urge Qualifications of Utility Commissioners

Experience in connection with public utilities should be made a necessary qualification for public service commissioners, according to a committee of engineers representing national and local engineering societies, which addressed a strong plea on the subject to the committee on public utilities of the Constitutional convention. In the judgment of the engineers, men familiar with the technical, financial, commercial and legal matters which come before a public service commission are best fitted to render valuable service to the public. The committee feels that there are to be found among those connected with public-utility companies men with as broad conceptions of public rights and of the duties to be fulfilled to the public as can be found in other walks of life.

The engineers also urged on the committee on public utilities that the point of greatest importance in any plan for an organization of the public-utility commissions of the state is the preservation of the principle of continuity already established in the present public service commissions, whereby the terms of office of the members of the commissions, whereby at different times, so that only one member of the commission at a time goes out of office.

Represented on the committee of engineers making these representations were the American Society of Civil Engineers, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Institute of Consulting Engineers, the New York Section of the American Institute of Mining Engineers, the Municipal Engineers of the City of New York and the Brooklyn Engineers' Club.

The committee of the convention having recommended that all public works except park control and conservation work be placed under a Department of Public Works administered by a superintendent appointed by and removable by the Governor, the committee of engineers has protested to Chairman Elihu Root, of the convention, again emphasizing the principle of continuity of control thru a commission changing but one at a time and having long terms of office for its members.

The engineers' committee also criticizes the ultra-conservatism of the conservation program of the convention, intelligent use and not prohibition of all use being the true definition of conservatism.

The committee also objects to two public utility commissions and to the failure to prescribe qualifications for commissioners and to limit the action possible by the legislature in fixing jurisdiction, powers and duties of the commissioners.

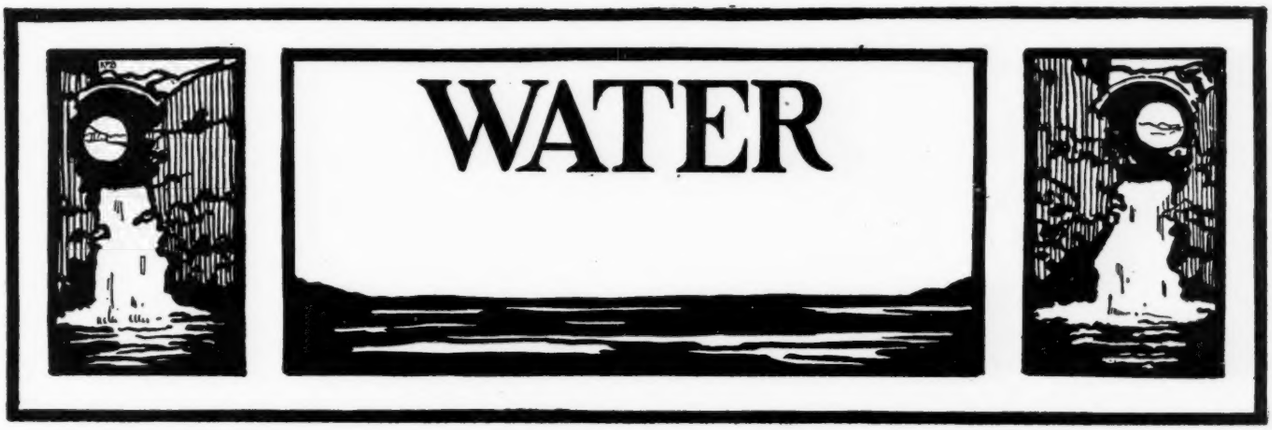
Integral Curb for Concrete Pavements.

By C. D. Frank.

The use of an integral curb with concrete pavements is by no means a new thing. It has frequently been used in connection with the construction of concrete driveways, but its use with public roads and streets of concrete has not been developed materially until the year 1914. An integral curb, if properly constructed, should serve all the purposes of a curb constructed separately from the pavement itself. Its cost will, of course, be materially less. The shapes of these curbs may be and have been of various types to comply with special conditions which are to be met with. One used at Geneseo, Ill., and two at Winnetka, Ill., may be formed by shaping the end of the strike-board to form the curbing. These types are applicable only to boulevards, park systems and light work where no definite curb is desired and yet a waterway is necessary. The extra material required for such curbs is so small that its cost is negligible, and it is doubtful if the cost of the pavement proper is increased to any appreciable extent thereby.

The cost of the integral curb on Thirty-fourth Street, Indianapolis, was 3 cents per square yard of pavement surface, which made the cost of the curbing 4½ cents per linear foot.

It is proved every day that no hard surfaced pavement can stand successfully unless the sub-grade is thoroly drained. The best place to put this drain is outside of the pavement itself, so as to intercept the ground water and prevent it accumulating under the pavement, where it will later cause trouble.



Municipal Water Plant Derives Income from Water Power

By W. B. Conant, Concord, Mass.

The Metropolitan Water and Sewerage Board of Boston, Mass., is about to undertake the utilization of the run-off at the dam of the Sudbury reservoir, a part of the metropolitan water supply system. The reservoir has a capacity of seven and a quarter million gallons. About 90 per cent of the flow of water will be used to develop electricity, but without impairment of the required supply to Boston for ordinary uses. The Sudbury basin lies nearer Boston and below the greater Wachusett reservoir of the system, and receives the greater part of its water from the latter. A generating station was put in operation at the Wachusett dam in 1911 and has generated about five million kilowatt hours a year since beginning service. The electrical energy is sold to the Connecticut River Transmission Company at 0.53 cent per kilowatt hour, which represents a substantial return on investment to the Metropolitan board.

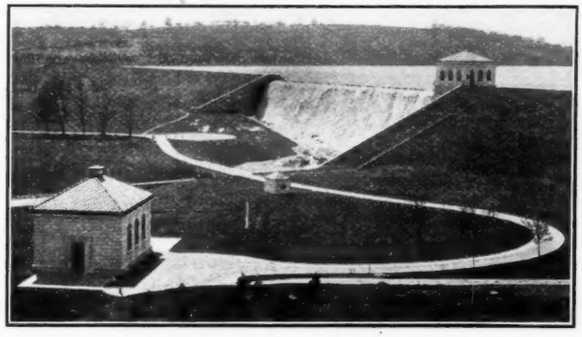
The Edison Electric Illuminating Company of Boston has contracted for five years to take the energy produced at the new Sudbury generating station, at 0.625 cent a kilowat hour. A 900-kva. and two 275-kva. vertical-shaft generators, directly driven by 1,000 and 300-hp. turbines, will be installed in the present granite gate house on the crest of the dam. A head of 60 feet is available on the larger unit and of 35 feet on the two smaller wheels, which will be located in chambers beneath the generators. About 650 kilowatts will be the average output of the station, but sufficient water power is available to generate a maximum of 1,400 kilowatts.

It is noteworthy that the value of water for domestic purposes exceeds that for power generation by thirty or forty fold, but the fact remains that an investment of $125,000, in the case of the Wachusett station, yields a revenue of some $30,000 yearly, and it is expected the Sudbury undertaking will be proportionately profitable.

The contracts with the purchasers of the power provide that the primary uses of water in the two reservoirs shall not be interfered with in operating the generating plants. In other words, the surplus alone is used to produce electricity, and this is available at certain times and seasons. It is interesting to note that the demands of the cities for their domestic supply, and of the electric companies for the delivery of electricity, are reciprocal. The Connecticut River Transmission Company derives the greater part of its supply from its own hydro-electric station in the western part of Massachusetts, while the Boston Edison Company has relied hitherto entirely on steam generating plants.

The practicability of using the surplus, in the case of Boston's water supply, has already been fully demonstrated, and is creating interest among engineers in other cities.

SUDBURY DAM *of the Boston Metropolitan Water Supply, at which hydro-electric apparatus will be installed to generate electric current to be sold.*

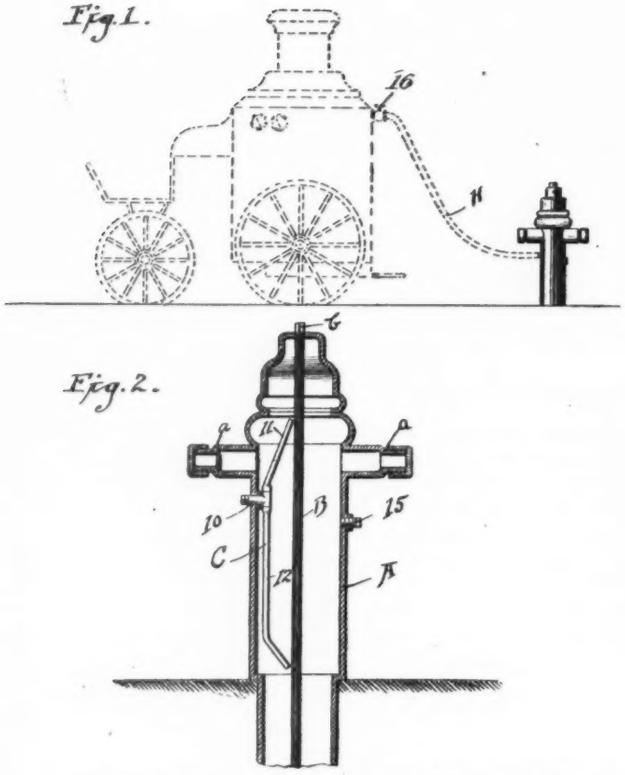


A Hydrant-Thawing Apparatus

The accompanying drawings, Figs. 1 and 2, and photograph, Fig. 3, show the details of construction, indicate the method of operation of a novel hydrant-thawing apparatus, designed at Bennington, Vt. The drawing, Fig. 1, shows a fire hydrant in elevation, a fire engine being indicated in dotted lines and an attachment with a hose connecting the boiler to the thawing apparatus.

In Fig. 2 the portions marked A represent the casing of the hydrant, B the valve stem for turning on and cutting off the water from the main, and C the thawing attachment. It will be seen that the hydrant is provided with hose attaching nipples and the valve stem with an angular upper end, b, for the attachment of a turning handle, or wheel, as usual. The thawing attachment, C, is arranged as follows: The hydrant casing, A, is formed with a perforation near its upper end, in which is mounted a T-fitting, 10, illustrated in photograph, Fig. 3, the outer end of which is adapted to have a hose such as H, as indicated by dotted lines in Fig. 1, leading from the boiler of the engine.

It will be noted that from one side of the T within the hydrant a branch pipe, 11, extends toward the top, and from the other side a branch pipe, 12, extends toward the bottom of the hydrant. The pipes 11 and 12 are bent at an angle with their discharge ends in close proximity to the valve stem B, and arranged to discharge toward the upper and lower ends of the hydrant. In the opposite side of the casing is provided an aperture, closed by screw plug 15, by which the products of condensation may be allowed to escape from the hydrant casing.



DEVICE FOR THAWING FIRE HYDRANTS. ABOVE, *a steam fire engine thawing out a hydrant by attaching steam pipe to the device.* BELOW, *section of hydrant showing the perforated steam pipe in place, which distributes steam from the casing at top to the valve below.*

When in use, the fireman, discovering that the hydrant which it is desired to use is frozen, connects the hose H with the fitting 10 and opens a valve, 16, at the connection of the hose with the engine boiler, when the steam from the boiler will be forcibly discharged into the hydrant from the discharge ends of the branches 11 and 12 of the thawing device. The steam, coming directly from the boiler and being forced into the opposite ends of the casing, will act very rapidly upon the ice or frost in the apparatus, and directly upon the points where freezing usually occurs—that is, around the valve stem where it extends thru the top of the casing and at its lower connection with the valve, or the valve casing.

It is clear that by this means the thawing is done very quickly, as the steam is applied directly to the points where the freezing usually occurs, and is therefore not wasted, and as every moment of time that can be saved in getting the apparatus ready for use is extremely valuable, this feature is of great importance.

Municipal Ice Plants

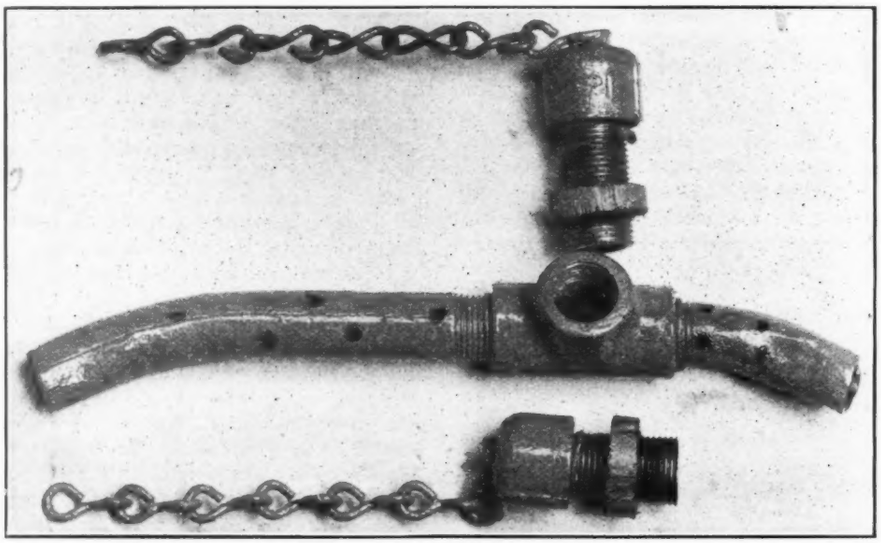
Municipal ice plants have been established at Weatherford, Okla.; New Britain, Conn.; Lafayette, Ala.; Fernandina, and Mayo, Fla. Kansas and Illinois are proposing legislation permitting municipal ice plants. When they can be established in connection with municipal electric plants or purchasing current at low rates, they result in lower prices for ice, as shown in a recent article in MUNICIPAL ENGINEERING. Cleveland and Indianapolis have refrigeration plants in connection with public markets and New York proposes a municipal cold storage plant.

Recent City Government Changes

The commission form of government has been aodpted recently in Jackson, Tenn.; Asheville, and Lincolnton, N. C.; Yoakum, Texas; Huron, S. D., and Hoboken, N. J., and failed to carry in McMinnville, Tenn., and Avon, N. J.

Tucson, Ariz.; Elizabeth City, N. C., and Sherman, Texas, have adopted the city-manager form and Wilmington, Charlotte and Burlington, N. C., and St. Augustine, Fla., have rejected it. Grand Rapids, Mich., has voted in favor of the Dayton form of commission-city-manager.

THE STEAM PIPE *used to thaw hydrants, showing perforations in the pipe, the T to pass thru side of hydrant and cap to close pipe when not in use, all water-tight under the water pressure when the hydrant is in use.*



MISCELLANEOUS

Convention of American Society of Municipal Improvements

The Twenty-second Annual Convention of the American Society of Municipal Improvements is scheduled for the new Hotel Miami, at Dayton, Ohio, on October 11 to 15, 1915, being the first convention in the new building and beginning but three days after its opening.

As is customary, the meetings of the sub-committees on various standard specifications will be held on Monday, October 11, preceding the convention, and each sub-committee will have its meeting with the general committee on specifications, beginning at 11 a. m., on Monday, with the committee on Wood Block Paving. Most of the standard specifications under consideration by the Society have been adopted and only minor changes will ordinarily be suggested. The wood block and bituminous paving specifications and two or three sections of the sewer specifications have not been adopted and will be up for discussion at this convention. It is understood that some changes in the specifications for broken stone and gravel roads will also be presented.

Garbage disposal in Savannah and in Dayton will be described by City Engineers Conant and Barlow.

Dr. Kleeberg will tell of Municipal Inspection Methods in Manhattan Boro.

Water Works Reconstruction in Hamilton, by City Engineer Macallum and Flood Prevention in the Miami Valley, by E. A. Deeds, chairman of the conservancy board, will occupy part of Wednesday morning.

Sewage Disposal and Stream Pollution are subjects of papers by T. Chalkley Hatton, who will describe the activated sludge experiments in Milwaukee, Prof. Earl B. Phelps and Geo. H. Norton.

As usual, the number of papers on street paving is large and includes two papers on granite block, one on asphalt repairs, one on bituminous pavement construction, two on cement concrete, four on wood block treatment and paving, and three on brick paving. The wood block problem will be treated from various points of view by J. W. Howard, P. C. Reilly, Hermann Von Schrenk and E. P. Dutton, and the discussion will be of particular interest since the standard specifications are up for consideration at this meeting, not having been adopted as yet. These paving papers are distributed over several sessions, but they will all be read before the report of the committee on standard specifications is made, on Thursday afternoon, October 14.

Municipal Legislation and Management are represented by several papers, including two by L. L. Tribus and Alexander Potter. The committee on traffic on streets has an extended report, and W. W. Crosby has a paper on the Traffic Census and the Selection of Pavements.

Many lines of Dayton's activities are represented on the programs for various sessions, including Garbage Disposal by the director of public service, J. E. Barlow; Flood Prevention, by E. A. Deeds, chairman of the conservancy board; the Dayton Government Plan, by City Manager H. M. Waite; two papers on Citizens Co-operation in Municipal Affairs, Individually and in Associations, by F. H. Rike, president of the Greater Dayton Association, and W. S. Crandall; and Health and Sanitation Work, by Dr. D. Frank Garland.

The entertainment features include a banquet tendered to the Association by the National Paving Brick Manufacturers' Association, and a trip about the city, inspecting its public works, its sanitation and the sites of some of the flood protection work, and the Wright Aviation Field in use. The entertainment of the ladies is in the hands of the Dayton Engineers' Club, who have laid out a very attractive program for them.

The preliminary program can be obtained of Charles Carroll Brown, secretary, 702 Wulsin Bldg., Indianapolis, Ind.

Brickmakers Organize to Improve Their Art

A series of events with most happy significance to the art of brickmaking has led to the organization of the Institute of Paving Brick Manufacturers. Its officers are F. R. Kanengeiser, president; D. E. Humphrey, vice president; Robert Keplinger, secretary, and Spencer M. Duty, treasurer.

The next meeting will occur at Alton, Ill., September 22. The place is selected with a view to the opportunity it affords to visit the plant of the Alton Brick Company. It has become the rule of the Institute to combine plant inspection with theoretical study, and its investigations at Alton will be a continuance of those pursued at the plants of the Bessemer Limestone Company, in Youngstown, and the Metropolitan Paving Brick Company, in Canton.

Like most organizations that fill a real need, the Institute is less the result of a deliberate plan on the part of an organizer than the outgrowth of a spontaneous desire on the part of certain manufacturers for more intensive practical study into brickmaking problems. Certain conferences held at the time of the Detroit meeting resulted in the appointment of a meeting in Youngstown on May 25, 1915. Officers were elected there and a committee was appointed to draw up a constitution and by-laws, which were adopted in a meeting at Canton on June 29.

"Whereas," recites the preamble, "there are now manufactured in the United States of America, from certain shales and clays, brick and block especially made for use in building and constructing streets and roadways, and, as it is desirable that such brick and block be manufactured in a manner best suited and adapted for said purpose, therefore the subscribers

hereto shall and do constitute a society to be known as the Institute of Paving Brick Manufacturers."

The object is further stated to include meetings, discussion and the reading of papers as a means of disseminating among the members further knowlege as to the manufacture of their product.

In distinction from those gatherings where brickmakers and men of allied occupations meet for interchange of ideas, the Institute meetings are designed for the paving-brick maker pure and simple. All active members must be actively connected with a reputable company manufacturing paving brick. For associate membership men may be admitted who are engaged in furthering the interests of the paving brick industry, even tho they are not brickmakers. An honorary membership is reserved for those whom the Institute chooses to honor for reasons satisfactory to itself. The dues of an active member are $20 a year, while an associate member pays $5 for each meeting attended.

The active members constitute the board of directors. Officers must be active members and no two of them identified with the same concern. Provision has been made for committees on membership and honorary membership, and also for a committee on programs, which will be responsible very largely for the measure of usefulness which the Institute attains, since it determines the subjects to be discussed at each meeting. Regular meetings are to be held quarterly.

The Institute will avail itself not only of the best technical talent for its programs and discussions, but will devote a generous portion of its time to plant inspection.

At the forthcoming Alton gathering inspection will occupy the day and the meeting will be held in the evening. A paper upon electric drives in paving brick plants, by Eb. Rodgers, will be a feature of this meeting.

The organization of this Institute is an evidence of the new day that has dawned in competitive industry, a day when competitors take mutual pride in the advance of their profession and realize that more is to be made by each thru a reputation for good service accruing to all, than thru jealousies and secrecy. The Institute is advancing one of the cardinal objects of the National Paving Brick Manufacturers' Association and has its hearty approval and co-operation.

A cordial invitation is extended to every paving brick manufacturer to attend the Alton meeting. Full particulars may be obtained from Secretary Keplinger, of the Metropolitan Paving Brick Company, at Canton, Ohio.

The Pan-American Road Congress

The co-operation of the American Highway Association and the American Road Builders' Association, with the aid of the Tri-State Good Roads Association and the series of technical conventions at the San Francisco Exposition, should make the road congress this year the largest yet held. The program promises one of the best.

Oakland, Cal., is the place of meeting and September 13 to 17 are the dates.

The historical, legal, administrative, financial and political phases of the road problem are to be discussed in papers by L. W. Page, director of U. S. Office of Public Roads; S. E. Bradt, secretary of the Illinois State Highway Commission; E. A. Stevens, New Jersey State Highway Commissioner; A. N. Johnson, Judge J. T. Ronald, Nelson P. Lewis, A. B. Fletcher, S. D. Gilbert, auditor of New York State Highway Commission, Clifford Richardson, G. P. Coleman, and others.

Problems of construction and their related subjects are treated by such experts as H. S. Graves, chief of the U. S. Bureau of Forestry; W. R. Roy, Washington State Highway Commissioner; Geo. W. Cooley, Minnesota State Highway Commissioner; W. S. Gearhart, Kansas State Highway Commissioner; Prof. L. S. Smith; F. F. Rogers, Michigan State Highway Commissioner; W. D. Uhler, Chief Engineer of Pennsylvania State Highway Department; Curtis Hill, City Engineer of Kansas City, Mo.; T. W. MacDonald, Iowa State Highway Commissioner; Richard H. Dana, president of U. S. Civil Service Reform League; Elmer Thompson, secretary of the Automobile Club of America; Prof. A. H. Blanchard; A. W. Dean, Chief Engineer of Massachusetts State Highway Association; W. H. Connell, Chief of Philadelphia Highway Bureau, and others.

The lessons of the congress will be drawn at the last session by Charles F. Stern, member of the California State Highway Commission.

The International Engineering Congress

The International Engineering Congress at San Francisco, Cal., opens its sessions on the morning of September 20. The general session of the afternoon is occupied by papers on the Panama Canal from several points of view. Papers on the physical and engineering features are scheduled for Wednesday and Thursday mornings in the section on Waterways, for Friday morning on the municipal problems in the section on Municipal Engineering, the Panama railroad reconstruction on Thursday morning in the section on Railway Engineering, electrical and mechanical installations of the Panama Canal on Thursday afternoon in the section on Electrical Engineering, papers on Thursday morning and Friday afternoon in the section on Naval Architecture and Marine Engineering.

While the Panama Canal has more papers devoted to it than any other subject, they will occupy but one of the ten volumes of the transactions of the congress.

Besides the sections named above, there are sections on Irrigation, Materials of Engineering Construction, Mechanical Engineering, Mining Engineering, Metallurgy and Miscellaneous engineering features, the latter including such subjects as aerial navigation, refrigeration, agricultural engineering, heating and ventilation and engineering education.

The Road Congress precedes the Engneering Congress and the meetings of the sustaining Engineering Societies are grouped about the same dates, in September and October, so that all the conditions are favorable for a very large attendance.

American Association of Engineers

Invitations have been sent by the American Association of Engineers to the engineering departments of all the principal railroads, corporations and firms in the City of Chicago, to attend a booster dinner, to be held at the Hotel LaSalle, September 14, 1915.

Prof. F. H. Newell, head of the department of civil engineering at the University of Illinois, and who until recently was director of the U. S. Reclamation Service, will speak at this dinner on the "Needs of Organization Among Engineers." The aims of the American Association of Engineers are to raise the standard of ethics of the engineering profession and to promote economic and social welfare of engineers; by affording means for the interchange of information; by maintaining a service clearing house; by affording patent and legal advice; by supervision of legislation and by proper publicity. A 30 percent. increase in membership, drawn from all parts of the United States, as well as from all branches of the engineering profession, has been registered by this organization during the past two weeks. Local chapters are being formed in St. Louis, Milwaukee, Indianapolis, and many of the larger cities. A National convention is to be held at the LaSalle Hotel, Chicago, on December 10 and 11, 1915. All engineers are invited and the engineering societies and clubs of the United States

are urged to be represented by engineering delegates. Further information may be obtained by addressing Arthur Kneisel, secretary, 29 S. LaSalle St., Chicago, Ill.

Technical Associations

The program of the convention of the Federation of Trade Press Associations, to be held at Philadelphia, Pa., September 7, 8 and 9, is full of value for the publishers of trade and technical papers and of advertisers in them, many of those listed being among the most noted experts in their fields.

A valuation conference on principles and methods of valuing public utilities will be held in Philadelphia, Pa., November 10 to 13, under the auspices of the Utilities Bureau, of which M. L. Cooke, City Hall, Philadelphia, is acting director.

The American Society of Civil Engineers holds its forty-seventh annual convention at San Francisco, September 16 to 18, 1915, overlapping the Good Roads Congress in Oakland and just preceding the Engineering Congress, which begins on September 20.

The Pacific Highway Association has changed the date of its convention to September 16 at San Francisco, so that it can add its forces to others to make the Pan-American Road Congress, beginning September 13, the largest yet held.

Technical Schools

The New York University School of Commerce, Accounts and Finance, has issued an announcement of the course of study in its evening sessions, extending thru three years.

"Wind Stresses in the Steel Frames of Office Buildings," by W. M. Wilson and G. A. Maney, has just been issued as Bulletin No. 80 of the Engineering Experiment Station of the University of Illinois. In designing an office building it is necessary to determine the stresses in the steel frame due to the wind pressure on the side of the building. There are a numbr of methods used to determine these stresses and they are all known to be more or less inaccurate. This bulletin presents a more accurate method and demonstrates the inaccuracy of the methods in use. The bulletin also presents a new approximate method which is more exact than the present methods.

Civil Service Examinations

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

Sept. 14: Petroleum engineer in Bureau of Mines, for service in the field, at $2,500 to $3,000 a year.

Sept. 22: Assistant irrigation engineer in Office of Public Roads and Rural Engineering, for service in the field, at $1,000 to $1,500 a year.

Sept. 22, 23: Laboratory assistant in petrography in Bureau of Standards at Pittsburg, Pa., at $1,080 a year.

What is Natural Asphalt?

A recent advance bulletin of the U. S. Geological Survey states that the output of "natural asphalt" in 1914 amounted to 77,588 tons. As the term "natural asphalt" is, in the language of the industry, exclusively applied to native bitumens such as Trinidad lake asphalt and Bermudez lake asphalt, it seems desirable to explain that, as used by the Geological Survey, natural asphalt includes only gilsonite, elaterite, grahamite, bituminous limestone and bituminous sandstone. In other words, the total of 77,588 tons of "natural asphalt" does not include the production of Trinidad and Bermudez, or any other natural asphalt, as this phrase is understood in the industry.

Engineering Designs Protected

The Cleveland Dock Engineering Company, Cleveland, have been granted a favorable decision in a suit at Detroit, brought for infringement of the design of a special type of concrete dock built by the company for the Detroit Iron and Steel Company, at Detroit, and later extended by the latter ignoring the original engineers and builders, and thus infringing the patent on the dock. The decision is of general interest in showing how patent protection enables an engineering firm to protect its ideas and designs.

Personal Notes

Bradford and Doolittle have offices in the Fletcher Trust building, Indianapolis, and in Washington for the practice of patent, trademark, copyright and corporation law.

Howard S. Reed, Asso. M. Am. Soc. C. E., consulting engineer, Phoenix, Ariz., for six years in charge of the Salt River (Roosevelt) irrigation project and for eleven years with the U. S. Geological Survey and Reclamation Service, is devoting his attention to municipal water works and irrigation systems.

Lewis Littlepage Holladay and Henry Negstad are consulting engineers in power plants, utilities and industries under the name of Holladay, Negstad & Co., with offices at 109 North Dearborn street, Chicago, Ill.

Henry Welles Durham, C. E., recently chief engineer of highways in Manhattan boro, New York, and Percival Robert Moses, E. E., consulting electrical and mechanical engineer, have opened offices at 366 Fifth avenue, New York, for highway and municipal engineering work.

Prof. Charles M. Spofford, M. Am. Soc. C. E., of the firm of Fay, Spofford and Thorndike, consulting engineers, Boston, and head of the Department of Civil and Sanitary Engineering of the Massachusetts Institute of Technology, has been appointed, by the governor of Massachusetts, a member of the Terminal Commission, constituted by a recent legislative act to investigate the subject of terminal facilities and the improvement of facilities for the transportation of freight in the Boston metropolitan district. This appointment is another recognition of the qualifications of engineers for service upon public boards.

Publications Received

Bulletin 566 of the U. S. Geological Survey gives Results of Spirit Leveling in Utah, 1897 to 1913.

A report of the progress made in various experiments in dust prevention and road preservation during 1914 has just been issued by the U. S. Department of Agriculture as Bulletin No. 257. This bulletin contains reports of experiments at Lemon City and West Palm Beach, Florida, in which local coralline rock has been utilized with satisfaction in conjunction with a bituminous binder. In addition to this, inspection reports are given covering the maintenance and repairs on the test roads at Chevy Chase, Maryland, and on the nine miles of bituminous surface treatment on the Rockville Pike. Reports of inspection are also given on the bituminous macadam construction which was carried out at Jamaica, New York, in 1911. There are also reports of recent inspections on work previously carried out at Ridgewood, New Jersey; Boise, Idaho; Ames, Iowa; Knoxville, Tennessee; Youngstown, Ohio; Newton, Massachusetts; Garden City, Dodge City, Bucklin and Ford, Kansas; and Bowling Green, Kentucky. No definite conclusions are offered other than those which can be drawn from the above reports of inspections.

Technical Paper No. 109 of the U. S. Bureau of Mines deals with the chemical and physical properties of the natural gases used in twenty-five cities of the United States and can be obtained by application to the Bureau.

MACHINERY AND SUPPLIES

Municipal Asphalt Plant for Calcutta

The city of Calcutta, India, recently ordered a 1,000-yard Cummer road asphalt plant.

E. H. Staber, engineer in charge for the municipality of Calcutta, had for many months advised against the hand mixing of asphalt in Calcutta street work, with the result that the city finally authorized him to purchase an American plant. This plant, which was shipped complete in four boxes by the F. D. Cummer & Son Co., Cleveland, and which will be used for the mixing of sheet asphalt, asphaltic concrete and asphalt macadam, is identical with the plant recently shipped to Melbourne, Australia, and illustrated, crated for steamer, in a recent number of MUNICIPAL ENGINEERING.

You See Your Lighting System Before You Buy

Next door to the Johns-Manville building, at Madison avenue and Forty-first street, stands an old brownstone mansion, one of the survivals of that not yet distant period when our merchant princes thought Murray Hill the center of residential New York, which has been acquired by the Johns-Manville Company with the idea of showing in appropriate surroundings all their various lighting fixtures for the modern home or office.

The old rooms have been restored and handsomely furnished and each one filled with lighting fittings appropriate to its character. Drawing, dining and bedrooms, hall, stairs and office, all have their correct setting and here the architect or his client can come and study quietly the exact effect of each form of light and each kind of fixture.

Hitherto, the trouble in displaying lighting equipment has been that it was impossible to get a correct idea of the complete fixture in advance. The metal parts came from one house, the glassware from another; and, if any special design or scheme was called for, it was only obtainable after considerable trouble.

Under the combination with the famous Mitchell-Vance lighting fixtures and the Gill Company's Parian glassware, the various departments of lighting design will be co-ordinated and in co-operation with the architect it will for the first time be possible to arrange a lighting system which shall form an architectural unit with the building as a whole.

The efficiency and economy of the J-M Linolite can here be seen and appreciated. This system is making rapid strides in favor for the lighting both of public and private buildings.

The Frink system of concealed lighting for banks, offices, etc., and the Frink Polaralite signs are wonderful examples of applied design.

The beauty of Mitchell-Vance brass and bronze work and the unique translucency of Gill Parian glassware form an exceptionally pleasing combination now, for the first time, made available by the enterprise of the H. W. Johns-Manville Company.

All of these are exhibited in endless variety and our readers will find a visit to the "new house" will be amply repaid, the displays on the first and second floors being particularly complete and attractive.

Motor Rollers for War Countries

The Austin-Western Manufacturing Co., Chicago, recently shipped ten carloads of road-building machinery to Russia. The same company has shipped to France during recent weeks twenty-five carloads of the same kind of machinery. The machinery is used to heal up wounds and scars left on the highways after the smoke of battle has cleared away.

The machinery consists largely of motor-driven road rollers of ten to twelve tons weight. Some of them are used to maintain the roads which constantly are torn up by the enormous motor-truck travel due to the war. The orders already received by the Chicago concern from the governments of France and Russia total in excess of $100,000 and other orders of equal proportions are anticipated in the near future.

"We take decided pleasure in manufacturing and selling something of a constructive character," states N. DeWind, sales manager. "We found ourselves in an extremely fortunate position a few months ago when the European nations began to feel the need of machinery to repair their roads. Before the war began we had agents in Europe and had placed a few small orders in Russia and other parts of the continent. But our foreign business had not been extensive. The manufacturers of France were unable to give any time to making road machinery, and England, altho still turning out the machinery, was not able to keep up with the demand. We were asked when we could deliver and our stock enabled us to answer that we were ready for immediate shipment. That's how we got the business. Now we are working day and night. Instead of being overstocked we are working on the defensive to keep up with the orders."

Mr. DeWind said the Austin company in its deals with the French and Russian governments is selling on the basis of cash f. o. b. New York. The company does not incur the risk attending shipping under the perilous conditions that are encountered in transatlantic commerce. "In some of our first trades with France we contracted on the basis of francs, but we did not lose much on the proposition at that time," Mr. DeWind added. "Now, however, our contracts are made on the basis of the dollar, and we get our money before the machinery leaves this country. Russia was prepared to pay us at once in dollars and did not even expect to offer rubles. Under present conditions, the only safe way to trade is for dollars.

"Some of the rollers that went in our first shipment to

France are being used now in the vicinity of Arras. Our shipments to Russia will go by way of Archangel. I understand it is the plan of the Russian government to keep that port open, even after the freezing season arrives, by keeping the ice cut open."

Motor-Driven Squeegee Used for First Time on Streets of Milwaukee, Wis.

Fred G. Simmons, superintendent board of public works, and Charles O. Davis, superintendent of street cleaning, city of Milwaukee, Wis., are experimenting with a new type of squeegee machine.

The photographic illustration herewith shows this machine equipped with spraying nozzles immediately ahead of the front wheels, as well as in front of rubber squeegee. This machine, which is made by the Kindling Machinery Co., is a German invention which has for some years been in successful operation in leading cities of the continent and, altho the great majority of the machines across the water are motor-driven, the machine illustrated is the first motor-driven squeegee operated in this country. The operation of a motor-driven type is identical with the horse-drawn type with the exception that the use of a larger capacity tank is permitted, as well as an additional row of spraying nozzles.

Mr. Charles O. Davis, under whose supervision the tests are being conducted, states that it is his intention to test out the practicability of a rotary broom attachment to be placed in front of the second row of spraying nozzles. It is the opinion of Mr. Davis that this broom will stir up or jar loose refuse which has become caked on the pavement. The second row of spraying nozzles will again dampen same, thus leaving dampened, loosened refuse for the rubber squeegee to remove and scrub into the gutter.

Experiments to date show three times the cleaning results effected by the horse-drawn type, which is in operation in such cities as New York, Baltimore, Boston, Ft. Worth, St. Louis, San Francisco, Houston, Milwaukee, Dallas, Louisville, Washington, D. C., and Minneapolis.

"A modern city," states Mr. Davis, "is no place for the horse. The horse loses heavily in efficiency in hot weather, the motor little. Then again, street cleaning during the day time handicaps traffic and as long as we endeavor to transact most of our street cleaning at night we must necessarily seek maximum yardage in minimum time. The motor machine, of course, equals the results obtained by several horse-drawn machines.

"When there is no cleaning to be done, a motor squeegee is many dollars cheaper per day to own than the number of horses required to do the same amount of work. The motor machine is a positive economy during its non-operative periods as compared with horse equipment."

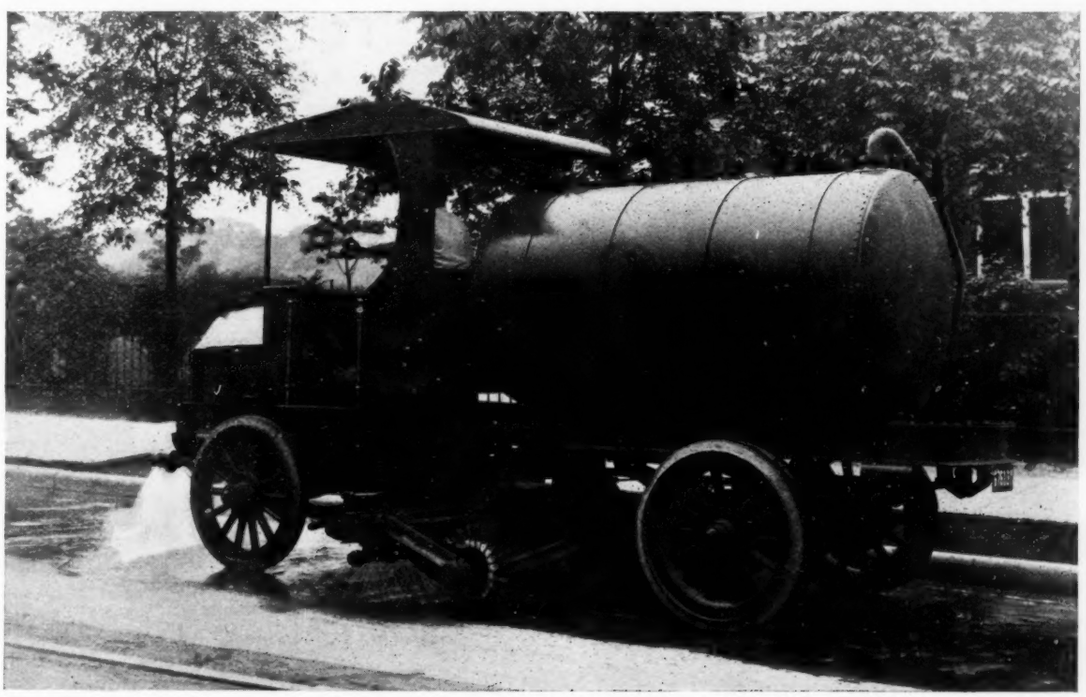
Portable Drilling Rig on Road and Street Work—Performance Records in Cutting Trenches and Cleaning Reservoirs

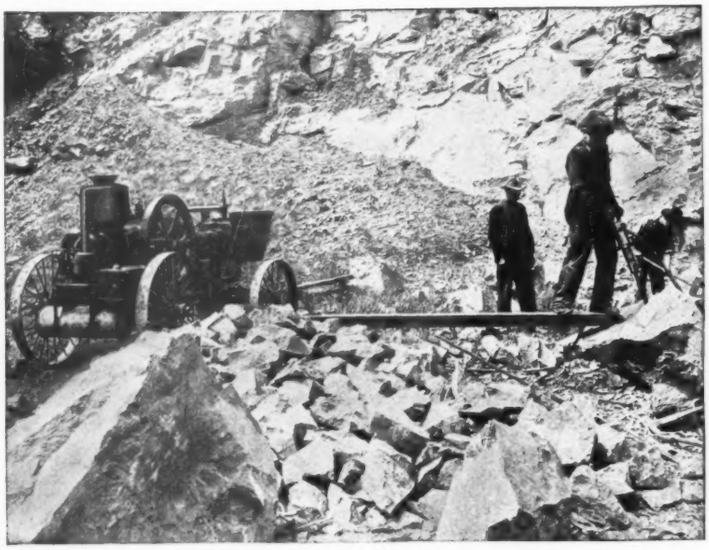
The Sullivan portable drilling rig is designed for removing rock in highway construction, in trenches for sewer pipes and water mains and in other work in which the rock to be excavated is scattered and too small in quantity to warrant a fixed compressor and drill plant. Other uses of these rigs include breaking up asphalt, brick, or concrete pavements; and, substituting hammers for drilling tools, the construction of steel bridges or buildings, calking the joints of gas mains, etc.

These outfits comprise a Sullivan class "WK-3" gas-engine-driven compressor, mounted on a two-horse wagon truck; and as drilling tools, one or more Sullivan hand-feed hammer drills. They can be used wherever a wagon may be hauled.

One New England city used a Sullivan outfit for several months in cutting trenches for water pipes. The rock consisted of granite ledges and boulders. The average footage, with one large and one small hammer drill, was about 160 feet of hole in nine hours. The compressor used about fifteen gallons of gasoline per day. The superintendent of the water works department estimated that there was a saving of from 65 to 75 per cent in the cost of removing rock in trench work with this outfit, as compared with hand drilling.

"DB-15" (25-pound) drills have been used very successfully in narrow pipe trenches at many points, among others





Louisville, Ky., and in 1909 at Bloomington, Ind. At the latter point forty eighteen-inch holes per drill per shift was the average performance of twelve drills for several months' work. The best record was 100 holes, or 150 feet of drilling, in a ten-hour shift, while thirty-six 3½-foot holes were drilled by one tool in seven hours. The oolitic limestone was of varying hardness, very irregular, full of mud pockets and often covered with water.

Records kept on the classes of work described above by the street department at Gloucester, Mass., show that the hammer drills, driven by a Sullivan portable compressor, did about three times as much work as the tripod drills accomplished previously. The cost of operation for the drills and compressor was about one-third less than that of the steam drills and boilers. Some of the performance records of the hammer drills are worthy of note. In sixteen hours' time the "DB-15" drill put in 47 feet in 25 holes, ranging from 19 to 36 inches deep, and the "DB-19" drilled 19 feet, or five holes running from 32 to 60 inches in depth. This included loading, shooting and all delays; and further, the drills were not operated at the same time. Holes five feet deep were drilled frequently in thirty minutes, and the best time noted for a hole of this depth was twenty minutes. This drilling was done in very hard dark-green bastard granite. Sullivan "WK-3" rigs, each with a Sullivan "DC-19" drill, are used by several Colorado county road departments. One of these, in Estes Park, is estimated to do as much work as fifteen hand drillmen.

In Salt Lake City, a contractor recently used a Sullivan hammer drill to remove old asphalt and concrete along street car tracks. This tool took the place of six laborers, and did considerably more than twice as much work, cutting the cost to less than half the previous figure.

A Yonkers (N. Y.) contractor used one of these outfits for clearing a reservoir site of boulders, and breaking them up for use in concrete. At first this work was done by hand at a cost of $1.50 per man per day. As each man was able to drill about five feet of block hole per day, the cost for drilling amounted to 30 cents per foot. After the purchase of the compressor and three Sullivan "DB-15" hammer drills it was found that these tools drilled an average of fifty feet each per day. The cost of operation was estimated as follows:

Three drill operators at $3.50 per day	$10.50
Compressor attendant	3.50
Gasoline per day, 15 gallons at 20 cents	3.00
Interest, renewals, wear and tear	6.00
Total cost per day	$23.00

Twenty-three dollars divided by 150 gives a cost of 15½ cents per foot of hole, which means a saving of 14½ cents per foot over hand work, or $21.75 per day. This saving soon paid for the equipment, and of course secured greater speed.

Modern Street Cleaning

It would appear that the ancient custom of watering asphalted streets will, in the very near future, be a matter of history only. From researches, which have been conducted by many American paving experts, the almost unanimous opinion has been evolved that modern cities should adopt what is termed the "dry" system of keeping down dust on well-paved streets. The advent of the automobile has much to do with the recommended innovation. Carefully prepared figures in regard to the wear and tear of pavements show that the wear is much more severe where watering is in vogue than when oiling is resorted to. The "dry" system as adopted by Providence, R. I., during the past three years, which is declared by the city's engineers to be eminently satisfactory, has many interesting features. The plan is very simple. The city is divided into sections to each of which are alloted daily patrols, while pneumatic cleaning machines pass constantly up and down the streets. The city engineer reporting on the system says: "Even if dry cleaning were not cheaper, its greater efficiency in keeping street surfaces in better condition merits its adoption. It has been proven that pavements of the bituminous kind have much greater durability when dry cleaned than when watered. When water is applied we have the condition which from all ages has been known to wear the hardest steel, and is, therefore, used in the grindstone, to-wit: The application of mud under a grinding process."—*Montreal Star.*

The New York *Evening World* joins in this sentiment, saying that sprinkling city streets permanently injures the pavements, besides making them dangerous to traffic. Experts, engineers and the street cleaning commissioner himself are agreed on this point.

Grading Machine Loads Nine Two-Yard Wagons in Ten Minutes

The illustrations on this page are from photographs of a grading contract executed by the R. F. Conway Company, of Chicago, Ill., on a street job, located on North Hamlin avenue, near Fulton avenue, Chicago, Ill.

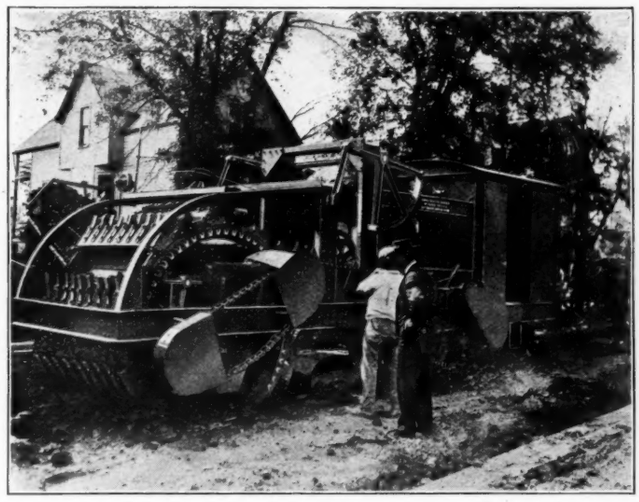
The machine illustrated is a Dennis traction grader and loader, manufactured by the Dennis Traction Grader Company, Milwaukee, Wis.

The soil in which this machine operated on this job was a sticky clay, and the work was under way during the period of heavy rains. While the hauling facilities were impaired by difficulties on the dump, and the grader could not be worked continuously to capacity, the machine demonstrated its ability to make a great cut in grading costs.

In this difficult digging the machine cut to grade and loaded nine two-yard wagons in ten minutes. The average cut was 18 inches.

The Dennis traction grader and loader is steam or gasoline powered, moving into the work of its own traction. On the large cylinders of each is fixed a series of twelve buckets, the digging edges of which are provided with rooters.

As the cylinders rotate, each bucket "bites" out its load and carries it to the continuously moving elevator, extending at right angles to the grader. The wagons in place under the elevator are loaded with a continuous volume of material.



The digging cylinder is adjustable perpendicularly from 2 to 24 inches. The grade is maintained by the operator, who, on the transit principle, sights on stakes and maintains his digging wheel at the proper depth.

The machine has seven speeds forward and reverse. The forward speed is adjusted to the depth of cut. The front end of the machine rests on two sets of Dennis multiplane tractors, which permits operation without planking. Each set of multiplanes is controlled by a separate clutch, and, in turning, one set is slowed or stopped, permitting the other set to predominate, accomplishing a short turn.

The width of cut is according to digging buckets, which, on the machine used by the Conway Company, was 5 feet. The grader is also built with 7-foot buckets.

The machine will work close to car tracks and curbs, as was demonstrated on the Conway job, on which the curbs were completed before the excavating started.

The Dennis traction grader and loader will work in any soil or in old macadam, and there is no question but that it is of extraordinary value in street and highway work, especially in solving the shallow grading problem.

Maney Four-Wheel Scraper

The Maney four-wheel yard-capacity scraper possesses the portable advantages of any two-wheeled scraper, yet has the additional quality of greater capacity. Loading is done by a four-horse snap team or by means of a tractor. The latter method is much to be preferred for the reason that the speed of loading is greatly increased. Usually one load per minute can be obtained by this method during actual operating time. The elimination of wheeler holders and dump men, with the corresponding saving in labor costs, practically offsets the cost of additional power required for loading, as compared with two-wheeled scrapers. The fact that the Maney in dumping its load, spreads the dirt in layers six inches and less, with the additional compacting action of the wheels on the loose dirt, is an important item in securing a dump with the minimum of shrinkage and the least amount of labor.

On the 23,500 square yard vitrified brick pavement job at Pekin, Ill., awarded to Jansen & Zoeller, of same city, in April, six Maney four-wheel scrapers, as above described, were used in the grading of approximately 12,000 cubic yards. These scrapers were loaded by tractor, making a round trip of 1,200 feet in approximately 14 minutes, or forty-three round trips per 10-hour day; 43 yards per scraper, totalling 258 yards per 10-hour day. The force engaged in the grading work consisted of seventeen men, six of whom were driving the scrapers, one running the tractor, two trimming up the edges of the cut near the scrapers, three making curb excavations ahead of the scrapers and five men on the dump. The dump is at the edge of the river bank. To reach it from the point at which the scrapers were working at the time of the writer's visit, it was necessary to haul nearly two blocks over the unimproved street, then to wind around a temporary road, cross several railroad tracks and then skirt the top of the bank to the dump. It was necessary for some of the scrapers to go part way down the bank to dump; others dumped along the top, and the men on the dump trimmed the material up. In returning to the loading point the scrapers took a slightly longer route to avoid interfering with the loaded scrapers moving toward the dump.

Mr. Edwin H. White, county superintendent of highways of Sangamon county, Ill., who made use of this style scraper on Jacksonville road work, states: "This work consisted in

THE MANEY *reducing grades in Sangamon county, Illinois, using tractor for loading.*

OPERATING MANEYS *on county road work in Indiana. D. H. Fatout, contractor, Indianapolis.*

reducing the grade of a hill from 11 per cent. to 5 per cent., which necessitated the moving of 4,500 cubic yards of dirt an average haul of 500 feet. The mean width of the cut was 41 feet. In using the Maney scrapers for this work we were able to do this work in about one-third of the time that would be required using the common wheel-scraper. My foreman informs me that he moved as high as 60 yards per hour on some of this work. The Maney bucket is suspended by two chains at the rear of the bottom of the bucket and two more from bails near the bottom of the front of the bucket. The rear chains are attached to the frame, the front ones lead to a spool on the superstructure of the machine. This spool has sprockets at either end, chain driven from the rear wheels. A clutch controls this action, so that when it is thrown in, and the scraper is in motion, the pan is raised from loading to carrying position. This clutch is operated by a foot lever. An automatic arrangement stops this winding at any point required, and a lever is also provided, whereby the operator can stop the winding at any point. Another lever releases the spool clutches and drops the pan into loading position. A dumping lever at the rear, when raised by hand, releases the end-gate and dumps the load from the rear."

The scraper described above is made by The Baker Mfg. Co., Springfield, Ill., and has figured prominently on street and road work throughout the Middle West. They have also been quite extensively used on so-called "downtown" street work and this field promises well for further extension. When used with tractor a cable with a hook at the end is fastened to the draw-bar of the tractor. The hook engages a steel snatch rod leading to the top of the head block casting at the front of the frame of the scraper. The tractor is thus enabled to load the scrapers quickly and easily without any previous loosening of the ground.

New Waterworks Appliances

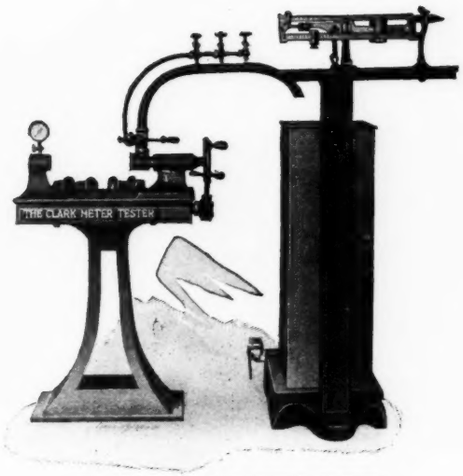
Among the new appliances recently devised by the H. W. Clark Co., Mattoon, Ill., is a new form of meter-coupling yoke, as well as an improved meter-testing machine.

The new Clark meter-coupling yoke accommodates meters of every manufacture. It is made in sizes ⅝, ¾ and 1-inch and is also made in a special size of ⅝-inch to accommodate meters with ¾-inch spuds. Stop cocks may be used inside of the meter box in connection with the coupling yoke when desired.

This new yoke is made of cast iron and brass and connection to pipes is without use of union or right and left fittings. The meter and riser pipes are held rigid. Contact with walls of meter box is avoided, thus eliminating dangers of freezing of meter. A ready and easy sliding adjustment is had for taking care of meters of different lengths and all expansion and contraction of the service pipe is readily taken care of. The lock shield adjusting screw construction, requiring a special socket key to operate, eliminates the necessity of sealing the meter, altho if a wire seal is desired in connection with the screws at the top of the meter, the same wire can readily be extended around any part of the yoke and a single seal used to seal the entire installation.

The Clark meter tester is made regularly in nine standard models in addition to many special constructions to fit unusual conditions. In the constructing of the line of Clark meter testers the makers have given special effort and study to the

THE CLARK METER COUPLING YOKE.



THE CLARK WATER METER TESTER.

individual requirements of the water department and the machine is constructed to meet these requirements at the lowest possible cost without providing any unnecessary equipment and expense, but supplying in every instance every requisite to the most rapid and accurate testing of meters. Among the leading features of this device should be mentioned its special construction for self-cleaning-flow test-valves, slow-opening inlet valve, quick-opening valve on the outlet side of meter, enabling flow thru same to be controlled identically as when in actual service and giving absolute control over test at all times; special construction of scale platform and base; rectangular tank construction; gages for determining pressures at both inlet and outlet, thus indicating loss of head due to meter friction.

Trade Notes.

The General Electric Company has on exhibit at the Panama-Pacific International Exposition at San Francisco an electrically fitted home and an electric railway.

American bitulithic paving material is to be used in the paving of Antofogasta, Chile.

The Badger Meter Manufacturing Company, of Milwaukee, Wis., was awarded the contract for furnishing Kansas City, Mo., with 2,000 ⅝-inch water meters.

Contract has been awarded to the MacArthur Concrete Pile and Foundation Company for the foundation of a new oil tank at the Standard Oil Company, East Boston, Mass.; for concrete pile foundation for Castleton Company's building, Toledo, O.; for the pile foundation for the new Alameda County Infirmary and Infirmary Hospital, in Alameda, Cal.; concrete pile foundation and walls of the coal bunkers, trackways for coal-handling bridge, etc., at the plant of the Western Fuel Company, Oakland, Cal.; the pedestal concrete piles for the new Union Station and power house of the Canadian Pacific Railway in Quebec, P. Q.; and pile foundation of barrel storage warehouse at the Pratt works of the Standard Oil Company, Long Island City, N. Y.

J. H. Lendi, formerly assistant to A. G. Carlson, mechanical engineer, Universal Portland Cement Company, has been given the title of electrical engineer in the engineering department of that company.

H. E. Wheeler, 440 South Dearborn street, Chicago, Ill., has been appointed western agent for Watson, Laidlaw & Co., Ltd., Glasgow, the largest manufacturers of centrifugal machines in the world and of other machinery for treating and handling chemicals and by-products.

In July two KisselKar combination hose and chemical trucks were driven from Pittsburg, Kans., to Parsons, Kans., a distance of forty miles. The drive was made the day following a two-weeks rainfall, and part of the run was over a river bottom with conditions the worst imaginable. They passed thru about four miles of bog, with the rear footboards frequently scraping the ground. The officials expressed themselves as amazed at the stamina of these trucks.

American Builders' Week at the Panama-Pacific International Exposition, San Francisco, Cal., October 18 to 23, is in charge of the General Contractors' Association, 110 Jessie street, San Francisco, from whose publicity committee full information can be obtained.

The Austin-Western Road Machinery Company, of Chicago, have opened an office at 314 Bulletin Building, Philadelphia, Pa., which will be in charge of E. M. Terwilliger, who has had many years of experience in road machinery and especially road rollers.

The war cut off the supply of chemicals for making blueprint paper, but the Keystone Blue Paper Co., Philadelphia, Pa., has supply on hand to last thru any reasonable continuation of the shortage in the general supply.

The Kissel Motor Car Company, of Hartford, Wis., reports a remarkable interest in its motor-driven sprinkling and flushing car. It is said that this car easily replaces six to eight horse-drawn wagons and therefore works a very important economy in street cleaning. In the Kissel apparatus, the discharge pipes are located in front, where they can be constantly observed by the driver. Driven down the center, it will sprinkle the entire width of an 80-foot street. The flusher will clean a 60-foot street in two round trips.

Trade Publications

The safety and welfare work of the Youngstown Sheet and Tube Co., Youngstown, O., is fully shown in a recent booklet of the company, which is well worth sending for.

A booklet, entitled "Municipal Progress," and relating to flushing versus dry cleaning of city streets, is issued by the General Motors Company, Pontiac, Mich. It contains information of interest to all street cleaning departments, as well as to mayors and those who are concerned with the conduct of public affairs. It discusses not only the sanitary advantages of proper street cleaning, but sets forth the statistical facts relating to the cost of the several methods in common use. A copy of the booklet will be supplied on request.

Chlorine control apparatus for water and sewage purification is elaborated upon, with full illustrations, in a booklet of Wallace & Tiernan Co., New York.

F. Wm. Stocker, West Hoboken, N. J., will send, on request, a booklet descriptive of his curb protecting bar and corner protection for concrete columns.

Bulletin No. 91 of the Cement-Gun Co., New York, is a brief article on tunnel waterproofing with cement-and-clay mortar fifty feet below sea level.

The Chicago Pneumatic Tool Co., Chicago, has issued Bulletin 34X, relating to their class A-G "Giant" Gas and gasoline engines in sizes from 16 to 130-h.p.

Catalog 8 of the C. H. & E. Mfg. Co., Milwaukee, Wis., concerns contractors' equipment, such as builders' hoists, material elevators, power-driven diaphragm bilge trench pumps, centrifugal pumps, piston pumps, manhole and force pumps, concrete chutes, mortar mixers, plaster mixers, grout mixers, air compressors, tar kettles and gasoline engines.

The Clark valve housing cover and lid is shown in a recent circular of H. W. Clark Co., Mattoon, Ill.

The Mott Sand Blast Mfg. Co., New York, have ready for distribution four descriptions of different sand blast machines which they manufacture.

CONTRACTING NEWS

AUTOMOBILES, FIRE APPARATUS.

CONTEMPLATED PURCHASES.

Bismarck, Ill.—Purchase of a chemical engine being urged. Address Mayor.

Columbus, O.—Ten new pieces of motor-driven fire apparatus contemplated and motorizing of 5 pieces of present equipment. $60,000 appropriated for purpose. Address City Council.

Hiawatha, Kans.—Motor apparatus under consideration. Address Mayor.

Hightstown, N. J.—New steam engine for New Jersey Fire Co. Address Mayor.

Omaha, Neb.—Motorizing fire department and installing fire alarm system at cost of $66,500. J. C. Dahlman, Mayor.

Pontiac, Ill.—Purchase of auto truck being discussed H. E. Torrance, Mayor.

FOREIGN TRADE OPPORTUNITIES.

No. 17992.—Possible market for sale of automobile trucks in Spain reported. Report may be examined at Bureau or its branch offices. Refer to file No. 63942.

No. 17999.—Engineer in France desires to communicate with manufacturers of auto plows with oil or electric motors. Will deal on cash basis and if necessary visit United States to make proper arrangements. Correspondence—French.

Names and addresses omitted may be obtained from Bureau of Foreign and Domestic Commerce, Washington, D. C.

BRIDGES.

BIDS REQUESTED.

Eaton, O.—Sept. 25, until noon, for substructure and superstructure of bridge across Little Creek. Certified check 10 per cent of bid. G. W. Rehfuss, Aud.

Ellsworth, Kans.—Until Sept. 18, for constructing reinforced concrete bridge, length 280 ft.; for repairing 250-ft. steel bridge and building 8 miles of roads and culverts in Garfield and Empire Twps. A. J. Klingenschmidt, Co. Clk.

Lawrence, Kans.—Oct. 6, until noon, for reinforced concrete bridge over Kansas River at Lawrence. Certified check, 10 per cent of bid. Herman Broeker, Clerk Douglas Co.

Manhattan, Kans.—Sept. 14, until noon, for bridge construction in Jewell Co. Address State Engr.

Matawan, N. J.—Sept. 8, until 11 p. m., for Strauss Trunion Bascule bridge over Matawan Creek, on South Amboy-Keyport Road. Certified check, $5,000. J. M. Corlies, Director, Bd. of Chosen Freeholders.

Norwalk, O.—Sept. 14, until 10:30 a. m., for improving Clarkfield Section 2 bridge at W. & L. E. railway. Certified check, $200. Chas. E. Bloomer, Aud. Huron Co.

Walla Walla, Wash.—Sept. 10, until 2 p. m., for Swegle bridge, consisting of one 102-ft. steel span, or two 50-ft. reinforced concrete arches. G. C. Cookerly, Engr. Walla Walla County.

CONTRACTS AWARDED.

Bradley, Cal.—To W. L. Gillham & Son, reinforced concrete bridge across Salinas river, at $14,400.

Grand Rapids, Mich.—D. W. Boyes, city, submitted lowest bid for bridge over Grand Trunk railway tracks on College ave., at bid of $12,908.

Seattle, Wash.—To Hans Pederson, city, concrete substructure and steel superstructure of 15th ave. steel bascule bridge, at $242,620; to Pacific States Construction Co., city, substructure of Fremont ave. steel bascule bridge, at $111,916, and to Beeis Bridge Co., city, superstructure of Fremont ave. steel bascule bridge, at $154,601.

Westport, Conn.—To McHarg-Barton Co., New York, bridge over Saugatuck river, length 515 ft., at $98,000.

Tucumcari, N. M.—To Missouri Valley Bridge & Iron Co., Kansas City, Mo., 5 bridges in Quay county, at $10,710.

CONTEMPLATED WORK.

Atlanta, Ga.—Plans made for 8 concrete bridges to replace wooden structures in Grant Park. J. O. Cochran, Gen. Mgr. of Parks.

Elizabethtown, Ky.—Bids will be received, probably in October, for Woolbridge Ferry probably in October, for Wooldridge Ferry 651, including abutments and fill, or $16,800 without them. R. P. Frankle, Road Engr.

Miami, Fla.—Bond issue for 2 bridges over Miami river will be voted on Sept. 21; one at Ave. D, costing $75,000, and one at Ave. G, to cost $25,000. D. H. Klyce, City Engr.

Seattle, Wash.—Repair of bridge on 23rd ave., west, to cost $7,000, planned. A. H. Dimmock, City Engr.

BUILDINGS.

BIDS REQUESTED.

Boston, Mass.—Sept. 15, until noon, for additions and alterations to following buildings: Administration bldg., at West Department of Boston city hospital, West Roxbury district; also to men's dormitory, whooping cough pavilion and diphtheria pavilion. Certified check for each contract, $200. John J. Dowling, M. D., Supt.

Cincinnati, O.—Sept. 12, until noon, for remodeling Lincoln public school and Washburn public school. C. W. Handman, Business Mgr. Board of Education.

Cincinnati, O.—About Sept. 15, for group of buildings for Walnut Hills high school on Madison rd., Hyde Park. Estimated cost, $1,000,000. Garber & Woodward, Archts., Union Central Bldg.

Indianapolis, Ind.—Sept. 14, until 10 a. m., for remodeling brick building at Winona Technical Institute, contract to include electrical work. John E. Cleland, Business Director.

Indianapolis, Ind.—Sept. 23, until 10 a. m., for brk. and cement bldg. for storage purposes at workhouse. W. T. Patten, Aud. Marion Co.

Lebanon, Ind.—Sept. 10, until 1 p. m., for 3-story brk. and stone hospital bldg. Jos. A. Coons, Pres. Bd. of Trustees.

Owensburgh, Ind.—Sept. 10, until 11 a. m., for grade and high school bldg for Jackson Twp., Green Co. W. H. Radcliffe, Twp. Trustee.

Winchester, Ind.—Sept. 10, until 1 p. m., for 2-story and basement brk. school bldg. Address Board of School Trustees.

CONTRACTS AWARDED.

Billerica, Mass.—To Leighton-Mitchell Co., 95 Milk st., Boston, 3-story brk. high school. Estimated cost, $90,000.

Binghamton, N. Y.—To Parsons Construction Co., city, general construction of two grade school bldgs., at $147,775.

Boston, Mass.—To J. J. Flynn, sixteen portable school house bldgs., at bid of $31,300.

Marysville, O.—To Showers & Taylor, city, erection of new school bldg., at $18,630.

Philadelphia, Pa.—Keystone State Construction Co., 704 Penn. Bldg., city, submitted lowest bid for Contract No. 101, subway and station under Filbert st., City Hall and S. Penn sq., at bid of $1,737,320.

Somerville, Mass.—To John E. Locatelli, city, 9-room school bldg. in East Somerville, at $37,500.

Tillamook, Ore.—To Frank Heyd, city, city hall at $20,000.

Utica, N. Y.—To Thos. F. Byrnes, city, Kernan school in West Utica, at $91,980 for main bldg. and $14,680 for annex.

CONTEMPLATED WORK.

Duluth, Minn.—Plans for fire hall and police station being prepared by F. G. German, Archt.

Lubbock, Tex.—New court house, estimated to cost $100,000, contemplated. L. A. Hitchcock, City Engr.

Monmouth, Ill.—Plans for fire-proof city hall accepted. Probable cost, $50,000. Otto Fowler, Mayor.

Plymouth, Ind.—Site purchased for high school bldg. Construction work to be started in spring. Address School Board.

Providence, R. I.—Bids to be asked soon for 18-room grammar school bldg. Stone, Carpenter & Sheldon, Archts. Joseph H. Gainer, Mayor.

Rensselaer, N. Y.—New school bldg. to replace school No. 1, recommended by Board of Education. Cost, $100,000. John McIntyre, Mayor.

St. Joseph, Mich.—$100,000 bond issue proposed for new high school. Wm. J. Cleary, City Engr.

LIGHTING.

Lancaster, Ky.—Installation of municipal electric light plant favored by city council.

Probable cost, $15,000. H. T. Logan, Mayor.

Madison, Wis.—Contract awarded Industrial Foundry Co., St. Johns, Mich., for installing ornamental lighting system, at $9,875.

Marathon, Iowa.—Bond issue of $12,000 for municipal electric light plant will be voted on in September.

New Orleans, La.—Survey of city being made for municipal electric light and power plant estimated to cost $6,000,000. Martin Behrman, Mayor.

Netawaka, Kans.—$10,000 bond issue voted for installation of electric light plant.

Rochester, Minn.—Bids will be asked shortly for municipal electric light plant. Estimated cost, $110,000. A. F. Wright, City Clk.

Sharon Springs, Kans.—Plans being prepared for remodeling municipal electric light plant. Estimated cost, $10,000. W. E. Hulse & Co., Engrs., Hutchison, Kans.

Wyandotte, Mich.—Bond issue of $21,000 for electric light plant improvements will be voted on Sept. 7. Chas. H. Marr, Mayor.

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Anderson, Ind.—Sept. 15, until 10 a. m., for grading, draining and paving Harold W. Farmer road with concrete. Joel B. Benefiel, Aud. Madison Co.

Cleveland Heights, O.—Sept. 7, until noon, for grading, draining, curbing and paving with brick, asphalt or macadam, portions of Derbyshire rd., Lenox rd., Norfolk rd. and Surrey rd. Certified check, 10 per cent of bid. H. H. Canfield, Village Clk.

Delphi, Ind.—Sept. 7, until noon, for macadam road in Rock Creek twp., Carroll co. M. G. Haun, co. aud.

Denton, Md.—Sept. 21, until noon, for 2.6 mi. shell macadam or concrete state highway. Harry Waldorf, co. road engr.

English, Ind.—Sept. 7, until 2 p. m., for stone rd. in Jennings twp., Crawford co. Joseph B. Enlow, co. aud.

Jeffersonville, Ind.—Sept. 7, until 10 a. m., for stone rd. in Jeffersonville twp., Clark co. Geo. W. Stoner, co. aud.

Linden, Ala.—Until Sept. 7, for about 40 miles sand clay gravel road. S. W. Gaines, Jr., engr., Selma, Ala.

Lorain, Ohio—Sept. 8, until noon, for 15,700 sq. yds. of vit. brk. or ashapit pavement, 5,300 lin. ft. curb, 5x21-in. and 6,000 cu. yds. excavation on E. 28th st. Certified check, 10 per cent. of bid. L. B. Johnston, clk. dir. of public service.

Shaker Heights, Ohio—Sept. 7, until noon, for grading, draining, curbing and paving with brk., concrete, asphalt or bituminous macadam, constructing sidewalks on Manchester rd. Also on Carlton rd. Certified check, 10 per cent. of bid. Carl A. Palmer, village clk.

Westfield, N. J.—Sept. 7, until 8 p. m., for improving sections of Dudley ave., Alston road and Scotch Plains ave., including 9,100 sq. ds. 6-in. macadam. Certified check, $500. Chas. Clark, town clerk.

CONTRACTS AWARDED.

Akron, Ohio—To L. H. Young Contracting Co., Austintown, Ohio, bituminous macadam on Akron-Youngstown rd., at $12,600; waterbound macadam on Akron-Canfield rd., at $15,920.54.

Bristol, Conn.—To Connecticut and Rhode Island Co., Amiesite pavement with 4-in. concrete base, on N. Main st., at $1.45 per sq. yd.

Clifton Springs, N. Y.—To Thos. F. Murray, LeRoy, 1,100 ft. improved road with curb and gutters, at $5,447.

Compton, Cal.—To Geo. B Curtis, Los Angeles, paving of Main st. and Compton ave. to city limits, at about $70,000.

Dayton, Ohio—To Clifton Hoolihan, city, brk. pavement on Grand ave., at $13,920.50.

Dennison, Ohio—To C. W. Hughes, Malta, Ohio, 1 mile of pavement on Newport road, at $11,565.30.

Georgetown, Del.—To The McNerney Construction Co., Canton, Pa., 4 miles road construction on Dupont blvd., at $46,877.31.

Miamisburg, Ohio—To Bigler Bros., Middletown, brk. blk. pavement on N. Main st., at $19,599.30.

Philadelphia, Pa.—James D. Dorney, 1204 E. Montgomery ave., city, submitted lowest bid for Contract No. 501, foundations in Front st., Kensington ave. and Frankford ave., at bid of $149,235.50.